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HABITAT TYPES OF THE MULE DEER CRITICAL WINTER RANGE AND ADJACENT STEPPE REGION OF MIDDLE PARK, COLORADO

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HABITAT TYPES OF THE MULE DEER CRITICAL WINTER RANGE AND ADJACENT STEPPE REGION OF MIDDLE PARK, COLORADO

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and

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Final Report on Colorado State University Project 31-1478-1462. Cooperative Agreement No. 16-739-CA, Project Title "Middle Park Habitat Type Analysis"

August, 1978

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TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	1
DESCRIPTION OF THE STUDY AREA	3
METHODS	4
KEY TO THE STEPPE HABITAT TYPES OF MIDDLE PARK, COLORADO	10
HABITAT TYPES WITHIN THE MULE DEER CRITICAL WINTER RANGE	13
Artemisia tridentata tridentata/Agropyron smithii habitat type	13
Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type	19
Artemisia tridentata wyomingensis/Agropyron smithii habitat type	24
Artemisia tridentata wyomingensis/Agropyron spicatum habitat type	30
Agropyron spicatum/Artemisia frigida habitat type	35
Juniperus scopulorum/Agropyron spicatum habitat type	41
Artemisia tridentata vaseyana/Festuca idahoensis habitat type	46
Amelanchier alnifolia/Agropyron spicatum habitat type	53
Amelanchier alnifolia/Carex habitat type	59
Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type	66
Oryzopsis hymenoides/Eriogonum brevicaule habitat type	70

TITLE	PAGE
HABITAT TYPES OUTSIDE THE MULE DEER CRITICAL WINTER RANGE	76
Artemisia longiloba/Poa secunda habitat type	76
Artemisia tridentata wyomingensis/Stipa columbiana habitat type	79
Purshia tridentata-Artemisia tridentata vaseyana/Festuca idahoensis habitat type	83
Agropyron spicatum/Poa fendleriana habitat type	88
Artemisia tridentata vaseyana/Festuca thurberi habitat type	93
Artemisia cana/Festuca thurberi habitat type	98
LITERATURE CITED	103
APPENDICES	104
A. Mapping unit identification legend for the habitat types mapped on the mule deer critical winter range in Middle Park, Colorado	105

LIST OF TABLES

TABLE		PAGE
1	Cover and frequency data for Artemisia tridentata tridentata/Agropyron smithii stands----------	15
2	Abiotic characteristics of the Artemisia tridentata tridentata/Agropyron smithii habitat type----	16
3	Phenological data for the important species in the Artemisia tridentata tridentata/Agropyron smithii habitat type----------	17
4	Cover and frequency data for Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii stands----------	21
5	Abiotic characteristics of the Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type----------	22
6	Phenological data for the important species in the Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type----------	23
7	Cover and frequency data for Artemisia tridentata wyomingensis/Agropyron smithii stands----------	26
8	Abiotic characteristics of the Artemisia tridentata wyomingensis/Agropyron smithii habitat type--	27
9	Phenological data for important species in the Artemisia tridentata wyomingensis/Agropyron smithii habitat type----------	28
10	Cover and frequency data for Artemisia tridentata wyomingensis/Agropyron spicatum stands----------	31
11	Abiotic characteristics of the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type----------	32
12	Phenological data for important species in the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type----------	33
13	Cover and frequency data for Agropyron spicatum/ Artemisia frigida stands----------	36

TABLE		PAGE
14	Abiotic characteristics of the Agropyron spicatum/Artemisia frigida habitat type----------	38
15	Phenological data for important species in the Agropyron spicatum/Artemisia frigida habitat type-	39
16	Cover and frequency data for Juniperus scopulorum/Agropyron spicatum stands----------	42
17	Abiotic characteristics of the Juniperus scopulorum/Agropyron spicatum habitat type----------	44
18	Phenological data for important species in the Juniperus scopulorum/Agropyron spicatum habitat type----------	45
19	Cover and frequency data for Artemisia tridentata vaseyana/Festuca idahoensis stands----------	48
20	Abiotic characteristics of the Artemisia tridentata vaseyana/Festuca idahoensis habitat type----------	50
21	Phenological data for important species in the Artemisia tridentata vaseyana/Festuca idahoensis habitat type----------	51
22	Cover and frequency data for Amelanchier alnifolia/Agropyron spicatum stands----------	55
23	Abiotic characteristics of the Amelanchier alnifolia/Agropyron spicatum habitat type----------	57
24	Phenological data for important species in the Amelanchier alnifolia/Agropyron spicatum habitat type----------	58
25	Cover and frequency data for Amelanchier alnifolia/Carex stands----------	61
26	Abiotic characteristics of the Amelanchier alnifolia/Carex habitat type----------	63
27	Phenological data for important species in the Amelanchier alnifolia/Carex habitat type----------	64
28	Layer and dominance rating for species in the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type----------	67

TABLE		PAGE
29	Phenological data for important species in the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type----------	69
30	Layer and dominance rating for species in the Oryzopsis hymenoides/Eriogonum brevicaule habitat type----------	71
31	Phenological data for important species in the Oryzopsis hymenoides/Eriogonum brevicaule habitat type----------	74
32	Layer and dominance rating for species in the Artemisia longiloba/Poa secunda habitat type------	77
33	Phenological data for important species in the Artemisia longiloba/Poa secunda habitat type------	78
34	Layer and dominance rating for species in the Artemisia tridentata wyomingensis/Stipa columbiana habitat type----------	80
35	Phenological data for important species in the Artemisia tridentata wyomingensis/Stipa columbiana habitat type----------	81
36	Layer and dominance rating for species in the Purshia tridentata-Artemisia tridentata vaseyana/Festuca idahoensis habitat type----------	84
37	Phenological data for important species in the Purshia tridentata-Artemisia tridentata vaseyana/Festuca idahoensis habitat type----------	87
38	Layer and dominance rating for species in the Agropyron spicatum/Poa fendleriana habitat type---------	89
39	Phenological data for important species in the Agropyron spicatum/Poa fendleriana habitat type---------	91
40	Layer and dominance rating for species in the Artemisia tridentata vaseyana/Festuca thurberi habitat type----------	94
41	Phenological data for important species in the Artemisiaia tridentata vaseyana/Festuca thurberi habitat type----------	97

TABLE		PAGE
42	Layer and dominance rating for species in the *Artemisia cana/Festuca thurberi* habitat type----------	99
43	Phenological data for important species in the *Artemisia cana/Festuca thurberi* habitat type----------	101

LIST OF FIGURES

FIGURE		PAGE
1	Artemisia tridentata tridentata/Agropyron smithii habitat type----------	18
2	Sarcobatus vermiculatus-Artemisia tridentata/ Agropyron smithii habitat type----------	18
3	Artemisia tridentata wyomingensis/Agropyron smithii habitat type----------	29
4	Artemisia tridentata wyomingensis/Agropyron spicatum habitat type----------	29
5	Agropyron spicatum/Artemisia frigida habitat type-	40
6	Juniperus scopulorum/Agropyron spicatum habitat type----------	40
7	Artemisia tridentata vaseyana/Festuca idahoensis habitat type----------	52
8	Amelanchier alnifolia/Agropyron spicatum habitat type----------	52
9	Amelanchier alnifolia/Carex habitat type----------	65
10	Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type----------	65
11	Oryzopsis hymenoides/Eriogonum brevicaule habitat type----------	75
12	Artemisia longiloba/Poa secunda habitat type------	75
13	Artemisia tridentata wyomingensis/Stipa columbiana habitat type----------	82
14	Purshia tridentata-Artemisia vaseyana/Festuca idahoensis habitat type----------	82
15	Agropyron spicatum/Poa fendleriana habitat type---	92
16	Artemisia tridentata vaseyana/Festuca thurberi habitat type----------	92
17	Artemisia cana/Festuca thurberi habitat type------	102

INTRODUCTION

The Steppe vegetation of Middle Park, including the critical winter range, was first studied at a reconnaissance level in relation to physical features such as soil, slope, aspect, elevation and geologic formation. The area within Middle Park identified as mule deer critical winter range was later studied in detail according to species cover, phenology and physical characteristics. This information provided the basis for classification of the area according to habitat types. A habitat type as defined by Daubenmire (1970), is, "The aggregate of all areas that support, or can support, the same primary climax."

Grazing by livestock has been an important factor influencing the development of the relatively stable plant associations of Middle Park and grazing at moderate intensities is expected to continue. Pristine sites are not available for study, therefore the floristic description of the habitat type may indicate plant species composition that are different from that which would exist under pristine conditions. However, identification of the landscape and their physical and edaphic descriptions will be identical to what is expected in pristince conditions. If landscapes differ significantly in floral compositions from what may be expected under pristine conditions it will be discussed in the habitat type writeup.

The purpose of this study was to provide ground truth information for the evaluation and development of remote sensing techniques to rapidly inventory our nation's renewable resources. The study of

habitat types in the Middle Park mule deer critical winter range not only provided a test site for development of remote sensing techniques but also will provide information essential for further research and assessment of mule deer carrying capacity.

Identification of the subspecies of Artemisia tridentata are difficult. The subspecies tridentata is usually easily identified if growing in the moist bottomland sites where it usually reaches heights of four to six feet. However, if growing intermixed with the subspecies wyomingensis on uplands, the two may not be separate morphologically. The subspecies vaseyana may be identified by its flat-topped appearance and by the fact that leaf material extracted with water fluoresce a light blue.

DESCRIPTION OF THE STUDY AREA

Middle Park is located in north central Colorado approximately 100 miles west of Denver. It is bounded on the north by the Rabbit Ears Range, on the west and southwest by the Gore Range and on the east and southeast by the Continental Divide including the Front Range.

The vegetation is dominated by big sagebrush in most of the area at the lower elevations and by aspen and coniferous forest at the higher elevations usually over 9,000 feet.

Precipitation in Middle Park is uniformly distributed throughout the year. The average precipitation over the last 41 years as recorded at the Green Mountain Dam is 15.72 inches per year (U.S. Department of Commerce, 1977). Kremmling is slightly dryer estimated at an average of 14 inches of precipitation per year. Most of the mule deer critical winter range lies within this range of precipitation.

Mean annual air temperature measured at the Green Mountain Dam at an elevation of 7740 feet averaged 40.2°F over the 41 year period.

METHODS

Field work was conducted during a period of two summers. Geological maps by Izett (1968) and Izett and Barclay (1973) and detailed soil maps were initially used for stratification of the study area and vicinity. This provided the means for a comprehensive reconnaissance study of habitat types in relation to different soils and geologic material. Stands were selected to be free of fire or other major disturbance with the exception of moderate grazing. Grazing was considered as one of many parameters that influence the development of relatively stable plant communities. The period of domestic grazing in Middle Park was considered long enough to allow plant communities to reach a stable stage of succession near climax.

The vegetation of each stand in the reconnaissance study was sampled according to layer and dominance rating for each species present. A number for each layer and dominance rating was assigned each species as follows:

Layer	Description
1	Ground layer usually less than 3 inches tall.
2	The first layer above the ground layer consisting primarily of grasses and forbs.
3	The low shrub layer including tall grasses and forbs less than 5 feet above the soil surface.
4	The tall shrub layer greater than 5 feet above the soil surface.
5	The tree layer.

Dominance Rating	Meaning
5	The species which dominates the aspect of the layer. It is dominant in the sense of its impact on the microenvironment beneath its canopy. Some stands may not have a species which clearly rates a 5. In such cases this class would not be used.
4	The species which is/are codominant in the aspect of the layer. This is the species which shares dominance with another or which is subordinant only to the layer dominant which rates a 5. A layer may thus have one or more species rating of 4. In stands lacking an outstanding dominant, the two (or rarely more) most important species (ecologically) may be assigned a 4-dominance rating if they are approximately equal in their apparent impact on the microenvironment.
3	The species which are easily seen by standing in one place and looking casually around.
2	The species which can be seen only by moving around in the stand or by looking intently while standing in one place. Species occurring in patches encountered only by moving about would be rated a dominance of 2 although within the patch the species may rate a higher dominance value.
1	Species which can be seen only by searching for them in and around other plants. Species which occur in extremely wide-scattered and isolated patches would rate a dominance of 1 provided they did not represent an inclusion of a different plant community.

The layer and dominance rating for each species has been used for analysis in habitat types outside the deer critical winter range as well as those habitat types of badland areas inside the deer critical winter range.

The physical characteristics of each stand in the reconnaissance study were described including soil characteristics, geologic material and formation, elevation, aspect, slope, position, relief, landform,

bare ground, surface stones, height of dominant species, disturbance if any, intensity of grazing and successional stage. A stand is defined for this study as a contiguous and homogenuous area of vegetation large enough for adequate sampling.

These stands were subjectively placed into groups of tentatively defined habitat types based upon similar floristic dominance and environmental simularities. Those habitat types found in the mule deer critical winter range were studied in detail the following summer. Habitat types occurring outside the mule deer critical winter range were sampled no further with the exception of collecting phenological data early in the summer.

Six stands for each of nine habitat types were studied in detail during the second summer. Vegetation was sampled for cover and frequency using 30 or 40 plots each 20 x 50 cm in size. These plots were spaced at 3 pace intervals along two parallel transects. Transects were speced 15 paces apart. Species cover classes were estimated according to the method described by Daubenmire (1970) with the exception of using 15 rather than 6 classes. The 15 cover classes used were as follows: 0(0%), 1(1%), 2(2%), 3(3%), 4(4%), 10(5-15%), 20(15-25%), 30(25-35%), 40(35-45%), 50(45-55%), 60(55-65%), 70(65-75%), 80(75-85%), 90(85-95%), and 98(95-100%).

Each class was recorded by its median value in the field which allows rapid calculation to percent cover without conversion from cover class. Frequency is the percent of the plots in a stand that any coverage of a species was recorded. Constancy is

the number of the stands of a habitat type in which a particular species was found to be present.

Mean species coverage data, standard error of the mean and percent frequency for each stand in each habitat type are given in tables associated with each habitat type description.

The habitat types were mapped on color aerial photographs at a scale of 3 inches to the mile. Mapping units were either single habitat types or complexes of usually two habitat types, which could not be delineated separately on the aerial photographs. Appendix A describes these mapping units.

Species area curves were used on a few different habitat types as a general guide to the number of plots needed per stand. In all cases, the curve leveled off after 20 samples. This indicated that the 30 or 40 plots per stand would include most species present in the stand.

The height of the dominant layer of shrubs was determined by measuring the height of shrubs along a transect until 30 measurements were made. Current annual growth was not included in measurements.

Erosion was described using a numerical Soil Surface Factor (SSF) developed by Jim Hagihara for the Bureau of Land Management. A Soil Surface Factor less than 40 was classified as slight, 41-60 as moderate and 61+ as severe.

Soil temperature was measured at 20 inches of soil depth or at a lithic or paralithic contact if less than 20 inches deep. The soil series were identified and all the physical parameters used in the reconnaissance study were described for the detailed study as well.

One stand from each habitat was observed every two weeks for phenological development of important species. Habitat types within the mule deer critical winter range were observed between May 15 and July 21 while those outside the critical winter range were observed between May 15 and June 21. Due to growing conditions many species remained in vegetative condition all summer. They did not produce flower or mature and dry-up during the period of observation.

All species were identified according to Harrington (1964) with the exception of species and subspecies of the genus Artemisia which were identified according to Beetle (1960). The use of ultraviolet light (Stevens and McArthur, 1974) was helpful in separating Artemisia tridentata subspecies vaseyana from other subspecies of Artemesia tridentata. Leaves of Artemisia tridentata subsp. vaseyana would fluoresce an intense blue color under ultraviolet light when crushed and placed in water. The other subspecies of Artemisia tridentata, subsp. wyomingensis identified in Middle Park did not fluoresce the light blue color described by Stevens and McArthur (1974). However, they indicated that this subspecies shows less blue color from samples collected from western Wyoming than samples collected in Nevada. We suspect the possibility of subspecies wyomingensis developing a light blue fluorescence in the fall but not in spring. This phenomenon is presently being studied further.

Specimens of species described in this report are in the Colorado Division of Wildlife's herbarium at Kremmling, Colorado.

KEY TO THE STEPPE HABITAT TYPES

OF MIDDLE PARK, COLORADO

1a. Sandy residual soils

PURSHIA TRIDENTATA-ARTEMISIA TRIDENTATA VASEYANA/FESTUCA IDAHOENSIS HABITAT TYPE.

1b. Loam or clayey residual soils and sandy alluvial soils

2a Soils of the cryoboroll great group.

3a Deep dark mollic epipedon present.

4a Soil on upland

5a Soil developed from colluvium + windblown parent material on steep, sloping upland. Snow drift sites.
AMELANCHIER ALNIFOLIA/CAREX HABITAT TYPE.

5b Soil developed from residual material on high elevation uplands adjacent to forest communities.
ARTEMISIA TRIDENTATA VASEYANA/FESTUCA THURBERI HABITAT TYPE.

4b Soil on alluvial floodplains at high elevations Boralfic cryoborolls.
ARTEMISIA CANA/FESTUCA THURBERI HABITAT TYPE.

3b Lithic cryoborolls

6a gravelly windswept ridges

7a less than 8200 feet elevation
AGROPYRON SPICATUM/ARTEMISIA FRIGIDA HABITAT TYPE.

7b Greater than 8200 feet elevation
AGROPYRON SPICATUM/POA FENDLERIANA
HABITAT TYPE

6b Steep rocky mountain slopes with many rock outcrops and residual parent material
JUNIPERUS SCOPULORUM/AGROPYRON SPICATUM
HABITAT TYPE.

3c Skeletal cryoboralls

8a Steep cobbly and stoney soils with colluvium parent material
AMELANCHIER ALNIFOLIA/AGROPYRON SPICATUM
HABITAT TYPE.

8b Gravelly soils on sloping upland
ARTEMISIA TRIDENTATA WYOMINGENSIS/AGROPYRON
SPICATUM HABITAT TYPE.

3d Argic cryoborolls

9a Shrink-swell clay pan at less than 12 inches
ARTEMISIA LONGILOBA/POA SECUNDA HABITAT TYPE.

9b Argilic horizon at greater depth.

10a Swale position or high elevation upland. Shallow snow accumulation site. Loam soil texture
ARTEMISIA TRIDENTATA VASEYANA/FESTUCA
IDAHOENSIS HABITAT TYPE.

10b Sloping upland, gravelly soils.
ARTEMISIA TRIDENTATA WYOMINGENSIS/AGROPYRON
SPICATUM HABITAT TYPE.

2b Aridisols with minimum horizon development. A1-horizon present plus an Argilic B-horizon-Borollic Haplargid.

11a Fine loamy soils, minimum argilic horizon, not salt affected.

12a Argilic horizon at shallow depth.

13a upland position

ARTEMISIA TRIDENTATA WYOMINGENSIS/ AGROPYRON SMITHII HABITAT TYPE.

13b bottomland position

ARTEMISIA TRIDENTATA TRIDENTATA/ AGROPYRON SMITHII HABITAT TYPE.

12b Argilic horizon at 15 inches or more.

ARTEMISIA TRIDENTATA WYOMINGENSIS/STIPA COLUMBIANA HABITAT TYPE.

11b Clayey soils, salt affected on alluvial fans, toe slopes or valley bottoms

SARCOBATUS VERMICULATUS-ARTEMISIA TRIDENTATA TRIDENTATA/AGROPYRON SMITHII HABITAT TYPE.

2c Shallow Solum-Cryorthents

14a Soil stable not highly eroded. White to gray colored clay, powdery when dry

ORYZOPSIS HYMENOIDES/ERIOGONUM BREVICAULE HABITAT TYPE.

14b Soil highly eroded (badland)

CHRYSOTHAMNUS PARRYI-ORYZOPSIS HYMENOIDES/ ERIOGONUM BREVICAULE HABITAT TYPE.

HABITAT TYPES WITHIN THE MULE DEER CRITICAL WINTER RANGE

ARTEMISIA TRIDENTATA TRIDENTATA/AGROPYRON SMITHII HABITAT TYPE

This is a topo-edaphic climax characterized by recent, dry alluvial stream terraces and upland swales where either lateral water flows or a water table exists at approximately 6 feet in soil depth (Figure 1).

Artemisia tridentata subspecies tridentata dominates the overstory with an average height of 54 inches. The understory is sparse with no obvious dominate. The most important understory species include Agropyron smithii, Sitanion hystrix, Chrysothamnus nauseosus var. glabratus, Penstemon caespitosus and moss.

This habitat type occurs at elevations that range from 7400 to 7800 feet. Slopes range from 0 to 20% at all aspects.

The major soils that occur are represented by the Harsha series, a member of the fine-loamy, mixed family of Borollic Hapliargids. Many of the soils have weaker developed subsoils and more sand and gravel than the Harsha series. The parent material is recent alluvium from the surrounding residual material including granite, gneiss, shale and sandstone. Pierre shale is the major source of alluvium.

The Artemisia tridentata wyomingensis/Agropyron spicatum habitat type differs in that it occurs on shallow gravelly soils, has a greater species diversity including Agropyron spicatum, Erigeron engelmanii and the substitution of Chrysothamnus viscidiflorus for Chrysothamnus nauseosus.

The Artemisia tridentata wyomingensis/Agropyron smithii habitat type also occurs on deep soils but on level terraces rather than concave swales and depressions. The average shrub height is much shorter, species diversity is greater, and Chrysothamnus viscidiflorus occurs rather than Chrysothamnus nauseosus. The Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat is located on clayey, saline alluvial fans just above the recent alluvial terraces near sharply incised stream channels. Willow and Cottonwoods occur on the present alluvial flood plain at the streams edge below the terraces occupied by Artemisia tridentata tridentata.

The floristic description of this habitat type may vary significantly from that on landscapes in pristine condition. Most of the stands in this habitat type are dissected by a gully through the center of the alluvial bottom. Such gullies will tend to make the site more xeric and discourage those species requiring more moisture. One typical species growing in such situations is Elymus cinereus. It was encountered at times on landscapes which were much more mesic than the average for this habitat as described herein. Thus in pristine conditions this habitat type may be called an Artemisia tridentata tridentata/Elymus cinereus habitat type.

Table 1. Cover and frequency data for Artemisia tridentata tridentata/Agropyron smithii association. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	10			25			28			33			35			45		
GRASSES AND GRASSLIKES																		
Agropyron smithii	.20	(.12)	10	6.83	(1.17)	93	3.23	(1.03)	43	8.50	(1.80)	80	.90	(.25)	36	1.46	(.56)	3
Bromus anomalus	.33	(.33)	3															
Bromus spp.																1.70	(.79)	20
Carex	.53	(.35)	10										.46	(.34)	10	.73	(.66)	6
Elymus cinereus	.13	(.09)	6	.10	(.10)	3										.20	(.14)	6
Juncus spp.	.40	(.33)	6															
Koeleria cristata										.13	(.13)	3						
Oryzopsis hymenoides							.33	(.33)	3	.06	(.06)	3				.40	(.33)	6
Poa fendleriana				.40	(.33)	6										.06	(.06)	3
Poa secunda										.13	(.13)	3						
Poa spp.	2.43	(1.23)	16													.36	(.33)	6
Stipa comata										1.33	(1.33)	3						
Stipa pinetorum							.06	(.06)	3	.03	(.03)	3						
Sitanion hystrix	2.06	(.62)	40	.96	(.47)	20	2.80	(.86)	43	1.46	(.57)	26	3.63	(1.22)	53	.50	(.35)	10
FORBS																		
Achillea lanulosa	.50	(.34)	13															
Aster spp.																5.43	(1.16)	73
Astragalus convallarius							.03	(.03)	03									
Astragalus flexuosus																9.00	(3.14)	7
Mertensia lanceolata	.53	(.21)	20							.03	(.03)	3						
Penstemon caespitosus	1.00	(1.00)	3	.36	(.33)	6	.06	(.06)	3	.03	(.03)	3	.46	(.35)	6	.33	(.33)	3
Penstemon strictus							.03	(.03)	3									
Potentilla concinna	.13	(.13)	3							.03	(.03)	3						
LICHEN				.06	(.06)	3	.23	(.13)	10	.70	(.66)	7	.40	(.17)	20			
MOSS	7.66	(2.69)	26	6.56	(3.29)	26	8.26	(2.79)	36	10.80	(3.57)	36	6.80	(3.81)	16	7.93	(3.18)	26
MUSTARD													.06	(.06)	3			
OTHER FORBS	2.20	(1.06)	33															
SHRUBS																		
Artemisia cana	2.66	(2.66)	3															
Artemisia tridentata subsp. tridentata	32.73	(5.50)	90	30.53	(4.93)	80	38.80	(5.55)	90	29.26	(4.12)	97	23.96	(4.39)	97	42.26	(4.91)	97
Chrysothamnus nauseosus var. glabratus	22.56	(4.96)	67	5.66	(3.20)	17				1.43	(1.04)	10	.73	(.66)	7	12.50	(3.49)	57
Ribes cereum	.33	(.33)	3															
Salix sp.	.33	(.33)	3															
BARE GROUND	48.53	(5.05)	100	38.66	(5.98)	83	53.06	(5.51)	97	48.53	(6.20)	90	51.06	(5.08)	97	36.36	(6.47)	87
LITTER	39.66	(5.14)	70	33.33	(3.00)	100	17.50	(2.34)	100	21.60	(2.58)	100	43.33	(3.66)	100	24.20	(3.43)	93
Total % Cover	83.77	(6.67)		51.50	(7.53)		53.87	(7.61)		53.97	(6.44)		37.43	(7.09)		82.93	(7.34)	
Species Diversity	20			11			12			16			11			16		

Table 2. Abiotic characteristics of the Artemisia tridentata tridentata/Agropyron smithii habitat type.

STAND NO.	10	25	28	33	35	45
Date of Sample	6/25/77	7/11/77	7/12/77	7/14/77	7/14/77	7/28/77
LOCATION:						
Quarter	NE,SW	NE,NW	NW,NE	NE,NW	SE,NE	SW,SW
Section	32	32	31	5	31	32
Township	2N	2N	2N	1N	1N	2N
Range	80W	80W	80W	80W	80W	80W
TOPOGRAPHY:						
Slope %	2	7	20	2	12	4
Aspect °Az	-	-	190	-	190	-
Position	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Elevation, ft.	7600	7700	7600	7520	7760	7520
LAND FORM	Bottom	Fan	Bottom	Bottom	Bottom	Bottom
Soil Temperature °C	14°	15°	15°	16°	15.5°	16°
Surface Cobbles & Stones %	5	1	40	0	0	0
DISTURBANCE:						
Grazing	Severe	Severe	Severe	Severe	Severe	Severe
Erosion	Slight	Moderate	Moderate	Moderate	Slight	Moderate
SSF	35	45	59	42	37	46
Successional Stage	Stable	Stable	Late Seral	Late Seral	Late Seral	Late Seral
Height of Dominant Layer (inches)	120	38.83	29.1	38.2	34.8	71.2

Table 3. Phenological data for the important species in the Artemisia tridentata tridentata/Agropyron smithii habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia tridentata subsp. tridentata	4	5			5/17,6/8,6/21[1]	7/14,8/20				
Penstemon caespitosus	1	4			5/17,6/20,7/14					
Chrysothamnus viscidiflorus	3	3		5/17	6/8,6/21,7/14		8/20			
Stipa pinetorum	3	3		5/17,6/8	7/14,8/20					
Agropyron smithii	3	3	5/17	6/8	6/21,7/14,8/20					
Sitanion hystrix	3	3	5/17	6/8	6/20,7/14,8/20					
Koeleria cristata	3	2	5/17	6/20	7/14,8/20					
Elymus cinereus	3	2	5/17,6/8	6/20,7/14,8/20						
Artemisia frigida	2	2			5/17,7/14,8/20					
Poa secunda	2	2		6/8	6/20,(90%)7/24			6/20(10%)[2]		
Symphoricarpos oreophilus	2	1			5/17,6/8					
Juniperus scopulorum	2	1			6/20,7/14					
Ribes cereum	2	1			6/20,8/20					
Carex sp.	2	1	5/17	6/8	8/19					
Potentilla concinna	2	1		5/17	6/8,6/20,8/20					
Gilia candida	2	1			5/17		6/20	8/20		
Chenopodium spp.	2	1				8/20				

[1]Refers to the date of observation

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Figure 1. Artemisia tridentata tridentata/Agropyron smithii habitat type.

Figure 2. Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type.

SARCOBATUS VERMICULATUS-ARTEMISIA TRIDENTATA TRIDENTATA/AGROPYRON SMITHII HABITAT TYPE.

This is a topo-edaphic climax characterized by clayey, saline and alkaline soils on alluvial fans and toe slopes where salts accumulate as a result of leaching from surrounding areas (Figure 2). Overflow is a common occurrence that prevents Sarcobatus vermiculatus from maintaining a pure overstory dominance. Rapid overflow tends to leach out the salt that has accumulated near the soil surface as a result of Sarcobatus vermiculatus cycling salts to the surface. Artemisia tridentata subspecies tridentata benefits from the leaching, increasing in overstory composition after each major overflow. Eventually Sarcobatus vermiculatus is able to regain dominance as it recycles salts to the soil surface. These salts inhibit Artemisia tridentata growth. This process is repeated again after each major overflow. The composition of these two species depends upon the time since the last overflow and the periodicity of overflow for each specific area. Species diversity is low with the most common species in the understory including Agropyron smithii, Sitanion hystrix, moss and an unidentified black lichen.

This habitat type occurs at elevations ranging from 7300 to 7700 feet. Slopes range from 0 to 20% at most aspects.

Most soils are clayey, saline, and alkaline as represented by the Harsha soil series, a member of the fine-loamy, mixed family of Borollic Haplargids. Other soils found within the habitat type are

Binco clay loam and Leavitte loam. However, all soils contain secondary lime at above 40" depth. The parent material is usually alluvial fan deposits primarily from Pierre shale of the Upper Cretaceous period.

The Artemisia tridentata, tridentata/Agropyron smithii habitat type is very similar except that Sarcobatus vermiculatus is absent and it occupies the sandier nonsaline stream terraces. All other Artemisia tridentata habitat types located outside the critical winter range also occur on clayey soils but have an extremely tight $B2_t$ horizon restricting root growth.

Table 4. Cover and frequency data for *Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii* association. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	17			19			22			37			43			44			
GRASSES AND GRASSLIKES																			
Agropyron smithii	.23	(.16)	7	5.00	(1.24)	40	1.06	(.73)	13	12.36	(1.22)	90	.93	(.46)	20	.10	(.10)	3	3.29/40.83
Bouteloua gracilis													4.86	(1.82)	30				
Carex										.13	(.13)	3							
Koeleria cristata													.33	(.33)	3				
Oryzopsis hymenoides							.03	(.03)	3	.13	(.13)	3							
Poa secunda										.23	(.13)	10							
Sitanion hystrix	4.93	(.93)	67	.56	(.36)	10	3.76	(.93)	50	1.90	(.78)	33	.36	(.18)	13	.76	(.38)	20	2.04/32.16
FORBS																			
Arnica cordifolia																.76	(.35)	27	
Aster spp.																.50	(.35)	10	
Erigeron eatonii																.50	(.35)	10	
Eriogonum brevicaule																.33	(.33)	3	
Mamillaria vivipara	.10	(.10)	3				.06	(.06)	3	.06	(.06)	3							0.03/1.50
Opuntia polyacantha										.80	(.67)	7							
Oxytropis sericea				.20	(.20)	3													1.09/21.9
Penstemon caespitosus				.76	(.67)	7				3.53	(1.58)	30	2.23	(1.21)	17				
Phlox bryoides							.13	(.13)	3	1.70	(.50)	40	.66	(.46)	7				.49/5.13
Phlox multiflora	.33	(.33)	3																
Sphaeralcea coccinea													.06	(.06)	3				
BLACK LICHEN	5.03	(1.59)	47	2.43	(1.38)	30	10.40	(2.62)	57	1.56	(.55)	37	.10	(.07)	7	.06	(.04)	7	3.26/20.83
LICHEN							3.20	(1.49)	37	2.76	(1.12)	40	.06	(.06)	3	.06	(.06)	3	1.56/13.54
MOSS	.06	(.06)	3	.06	(.06)	3	.33	(.33)	3	1.40	(.56)	27	1.46	(1.33)	10	.36	(.33)	7	.61/5.88
MUSTARD										.03	(.03)	3							
SHRUBS																			
Artemisia frigida										1.56	(.48)	43							
Artemisia tridentata subsp. *tridentata*	18.03	(3.89)	70	18.73	(3.75)	63	24.86	(4.75)	63	21.13	(4.53)	63	18.96	(3.46)	73	21.83	(4.36)	67	20.59/60.50
Chrysothamnus nauseosus var. *glabratus*																7.06	(2.13)	40	.86/4.50
Eurotia lanata	2.03	(1.00)	17				2.33	(.87)	30	.80	(.47)	10							9.54/77.54
Sarcobatus vermiculatus	12.16	(3.86)	43	11.83	(3.94)	40	6.96	(2.39)	40	5.73	(2.73)	23	10.00	(4.47	20	12.40	(3.04)	47	
Tetradymia canescens										.40	(.33)	7							61.3/93.59
BARE GROUND	66.13	(4.19)	100	67.73	(3.58)	100	65.06	(4.44)	100	51.66	(4.04)	100	63.00	(5.44)	97	54.26	(4.69)	100	
LITTER	17.53	(2.94)	90	13.80	(2.01)	90	10.86	(1.62)	100	14.03	(1.71)	100	7.36	(1.15)	100	19.76	(2.89)	100	13.84/96.07
Total % Cover	42.93	(4.80)		39.60	(4.76)		53.17	(5.45)		56.27	(4.79)		40.07	(6.55)		44.77	(4.70)		
Species Diversity		11			10			13			20			14			14		

Table 5. Abiotic characteristics of the Sarcobatus vermiculatus-Artemisia tridentata tridentata/ Agropyron smithii habitat type.

STAND NO.	17	19	22	37	43	44
Date of Sample	8/12/77	7/6/77	7/7/77	7/19/77	7/26/77	7/28/77
location;						
Quarter	NE,NW	SE,NW	SE,SE	SE,NW	SE,NE	SE,SE
Section	21	8	20	7	7	31
Township	1N	1N	1N	1N	1N	2N
Range	80W	80W	80W	80W	80W	80W
TOPOGRAPHY:						
Slope %	2	10	10	5	20	10
Aspect °Az.	-	155	220	-	170	210
Position	Bottom	Lower 1/3	Bottom		Lower 1/3	
Elevation, ft.	7300	7400	7400	7500	7400	7520
LAND FORM	Fan	Fan	Fan	Fan	Fan	Fan
Soil Temperature °C	19°	19.5°	19°	19°	19°	18°
Surface Cobbles & Stones %		5	10		7	20
DISTURBANCE:						
Grazing	Slight	Moderate	Moderate	Severe	Moderate	Severe
Erosion	Severe	Severe	Severe	Moderate	Moderate	Severe
SSF	66	64	61	60	59	70
Successional Stage	Stable	Stable	Stable	Late Seral	Stable	Stable
Height of Dominant Layer (inches)	28.6	16.7	19.47	17.03	25.83	28.63

Table 6. Phenological data for the important species in the Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Sarcobatus vermiculatus	3	4	5/16[1]		6/5(50%)[2]	6/5(50%), 6/21	7/7		8/19	
Artemisia tridentata subsp. tridentata	3	4			5/16,6/5	6/21,7/7, 8/19				
Sitanion hystrix	2	4		5/16,6/5,6/22	7/7					
Lichen	1	4			5/16,6/22, 7/7					
Agropyron smithii	3	3	5/16	6/5	6/22,7/7, 8/19(90%)	8/19(10%)				
Eurotia lanata	2	3		5/16	6/5	6/21,7/7	8/19			
Phlox bryoides	1	3						5/16,6/5, 6/22	7/7	
Mamillaria vivipara	1	3						5/16,6/5, 6/22		
Chrysothamnus nauseosus var. glabratus	2	2	5/16	6/5						
Amelanchier alnifolia	2	1							6/22	
Koeleria cristata	2	1	5/16							
Oryzopsis hymenoides	2	1		5/16	6/5,6/22				8/19	
Poa secunda	2	1		5/16,6/5						
Elymus cinereus	2	1	6/22							
Haplopappus armeroides	2	1		5/16						
Penstemon caespitosus	1	1			8/20					

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

ARTEMISIA TRIDENTATA WYOMINGENSIS/AGROPYRON SMITHII HABITAT TYPE.

This habitat type is a climatic climax characterized by an overstory of Artemisia tridentata subspecies wyomingensis with an average height of 15 inches (Figure 3). The associated understory is dominated by Agropyron smithii. Other important members of the community include Phlox bryoides, Poa secunda, Sitanion hystrix, Bouteloua gracilis, Stipa pinetorum, and Chrysothamnus viscidiflorus var viscidiflorus.

This habitat type occurs at elevations that range from 7300 to 7600 feet. Slopes are not usually steeper than 20% with no dependency upon aspect. The topographic position is undulating terrace and plateau tops. Bare ground occupies about 50% of the area.

The major soil that occurs within this habitat type is represented by the Harsha series, a member of the fine-loamy, mixed family of Borollic Haplargids. Other soils include the Leavitte series which has darker surface soil colors. The parent material is primarily loess and basin filled fine textured material of terrace deposits above the recent floodplain, and Troublesome Formation.

The Artemisia tridentata vaseyana/Festuca idahoensis habitat type also occurs on deep soils but they are darker colored mollisols at higher elevations where the environment is cooler and more mesic. Bare ground occupies half as much area. Species diversity is much greater for this higher elevation habitat type and includes species that require more moisture such as Phlox multiflora, Symphoricarpos oreophilus, Festuca idahoensis, Lupinus species, Mertensia lanceolata and Poa fendleriana. These species do not occur significantly in the

Artemisia tridentata wyomingensis/Agropyron smithii habitat type.

The Artemisia tridentata wyomingensis/Agropyron spicatum habitat type differs in that it is specific to shallow gravelly soils on steeper upland positions. Agropyron spicatum rather than Agropyron smithii dominates the understory.

The Artemisia tridentata tridentata/Agropyron smithii habitat type occurs on recent stream terraces and swale positions, where there is a possible water table during parts of the year within the rooting zone. Phlox bryoides is absent and Chrysothamnus nauseosus is present rather than Chrysothamnus viscidiflorus.

The Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type occurs on toe slopes of saline and alkaline soils, and Chrysothamnus viscidiflorus var. viscidiflorus is absent.

Table 7. Cover and frequency data for Artemisia tridentata wyomingensis/Agropyron smithii stands. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	4			18			23			46			51			54			
GRASSES AND GRASSLIKES																			
Agropyron smithii	7.35	(.99)	80	.80	(.38)	20	9.50	(1.29)	100	8.23	(1.79)	87	11.23	(1.90)	100	17.10	(1.61)	100	9.04/81.17
Agropyron spicatum				.13	(.13)	3													
Bouteloua gracilis	1.22	(.38)	30				.76	(.46)	10	.06	(.06)	3	3.26	(1.41)	37				.88/13.33
Carex	.02	(.02)	2							.10	(.10)	3	1.00	(.47)	23	.40	(.33)	7	.25/5.33
Koeleria cristata				.26	(.11)	17										5.00	(1.39)	43	
Oryzopsis hymenoides				2.13	(1.07)	27										.13	(.13)	3	
Poa fendleriana							.46	(.34)	10	.33	(.33)	3	.33	(.33)	3				.17/2.67
Poa secunda				4.76	(1.02)	73	.06	(.06)	3	.13	(.13)	3	.16	(.13)	7	8.83	(1.59)	77	3.22/27.17
Sitanion hystrix	1.55	(.76)	17	1.96	(.56)	43	.06	(.06)	3	1.36	(1.04)	10				.33	(.33)	3	.88/12.67
Stipa comata	.62	(.35)	10				1.16	(.73)	13				1.03	(.73)	10				.47/5.50
Stipa pinetorum	.97	(.56)	12				.33	(.33)	3				.43	(.20)	17	.60	(.36)	13	.34/5.50
FORBS																			
Antennaria parvifolia							1.00	(1.00)	3										
Astragalus convallarius										.03	(.03)	3				.06	(.04)	7	
Erigeron engelmanii																.03	(.03)	3	
Eriogonum umbellatum	2.90	(.89)	42				1.96	(.48)	53				2.83	(.85)	47	.33	(.33)	3	1.34/26.17
Mamillaria vivipara				.20	(.13)	7	.10	(.10)	3				.03	(.03)	3	.26	(.15)	10	.10/3.33
Mertensia ciliata													.03	(.03)	3				
Opuntia polyacantha													.13	(.13)	3				
Penstemon caespitosus				.70	(.46)	10				.23	(.16)	7				.70	(.66)	7	.27/4
Penstemon strictus				.13	(.09)	7													
Phlox bryoides	5.12	(.88)	62	6.93	(1.87)	60	8.03	(1.49)	73	1.90	(.50)	47	3.13	(.92)	43	3.53	(.90)	70	4.77/53.17
Tryfolium gymnocarpon	.02	(.02)	2																
BLACK LICHEN				1.26	(.38)	50	.16	(.09)	10	.06	(.04)	7	.23	(.09)	20				.53/14.50
LICHEN	2.10	(.33)	84				3.56	(.66)	70	.93	(.67)	17	.43	(.15)	30	1.86	(.47)	60	1.49/35.50
MOSS				.26	(.18)	7	2.03	(1.36)	17	6.06	(1.80)	40				10.76	(2.60)	87	3.64/43.17
SHRUBS																			
Artemisia frigida		1.37	(.60)		20				.66		(.24)	27	.63	(.37)	13	.06	(.06)	100	.45/26.67
Artemisia tridentata subsp. wyomingensis	17.52	(3.33)	76	33.36	(4.06)	87	22.76	(4.17)	83	27.16	(4.25)	80	24.86	(4.42)	77	26.53	(4.19)	93	25.33/82.67
Chrysothamnus viscidiflorus var. viscidiflorus	6.72	(1.11)	70				2.53	(.72)	43	4.00	(2.06)	13	.60	(.37)	10	2.56	(.90)	33	4.73/28.17
Eurotia lanata																.03	(.03)	3	
BARE GROUND	50.50	(3.18)	100	50.66	(4.20)	100	50.66	(3.55)	100	54.86	(4.03)	100	52.93	(4.93)	100	42.66	(4.03)	100	50.39/100
LITTER				5.50	(.82)	87	6.56	(1.01)	100	11.80	(1.27)	100	13.53	(1.74)	100	14.10	(2.22)	100	8.52/81.17
Total % Cover	47.52	(3.80)		55.93	(4.39)		55.20	(5.42)		51.27	(6.00)		49.83	(5.25)		79.10	(5.33)		
Species Diversity		14			15			19			17			19			20		

Table 8. Abiotic characteristics of the Artemisia tridentata wyomingensis/Agropyron smithii habitat type.

STAND NO.	4	18	23	46	51	54
Date of Sample	8/17/77	8/18/77	7/8/77	7/28/77	8/9/77	9/15/77
LOCATION:						
Quarter	SE,SE	SE,NE	NE,NE	NE,NW	SW,NW	NW,SE
Section	6	29	7	5	7	13
Township	1N	1N	1N	1N	1N	1N
Range	79W	80W	79W	80W	79W	80W
TOPOGRAPHY:						
Slope %	8	10	2	7	10	4
Aspect °Az.	145	245	-	-	145	-
Position	Top	Top	Top	Top	Lower 1/3	Top
Elevation, ft.	7500	7400	7400	7520	7500	7440
LAND FORM	Terrace Plateau	Terrace	Terrace Uplands	Terrace Plateau Uplands	Terrace Uplands	Terrace Uplands
Soil Temperature °C	20°	19°	20°	18°	18°	17°
Surface Cobbles & Stones %						
DISTURBANCE:						
Grazing	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Erosion	Moderate	Moderate	Slight	Moderate	Moderate	Slight
SSF	49	52		49	56	37
Successional Stage	Stable	Late Seral	Slight	Stable	Stable	Stable
Height of Dominant Layer (inches)	16.75	14.63	9.5	17.37	15.77	17.73

Table 9. Phenological data for important species in the Artemisia tridentata wyomingensis/Agropyron smithii habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia tridentata subsp. wyomingensis	3	5			5/14[1],6/5	6/22,8/19				
Poe fendleriana	2	4	5/15	6/5(75%)		6/5(25%)		6/22		
Oryzopsis hymenoides	2	4	5/14	6/5		6/22			8/19	
Penstemon caespitosus	1	4			5/14,6/5, 6/22(90%)		6/22 (10%)		8/19	
Phlox bryoides	1	4					5/14,6/5 (25%)	6/5(75%) 6/22	8/9	
Artemisia frigida	2	3			5/14,6/5.6/22		8/19			
Agropyron smithii	2	3	5/14	6/5	6/22,8/19(65%)		8/19 (35%)			
Poa secunda	2	3				6/22			8/19	
Sitanion hystrix	2	3		5/14,6/5	6/22(90%)	6/22(10%)			8/19	
Chrysothamnus nauseosus var. glabratus	3	2	5/14		6/5,6/22		8/19			
Gutierrezia sarothrae	2	2	6/5				8/19			
Bouteloua gracilis	2	2	5/14							
Koeleria cristata	2	2	5/14	6/15(80%)		6/15(20%)	6/22, 8/19(10%)		8/19(90%)	
Mamillaria vivipara	1	2				5/14	6/5	6/22	8/19	
Chrysothamnus parryi var. attenuatus	2	1			6/22					
Agropyron spicatum	2	1	5/14	6/5						
Stipa pinetorum	2	1	5/14							
Elymus cinereus	2	1		6/22	8/19					
Eriogonum umbellatum	2	1			5/14				8/19	
Eriogonum brevicaule	2	1				8/19				
Tryfolium gymnocarpon	1	1	6/5							

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Figure 3. Artemisia tridentata wyomingensis/Agropyron smithii habitat type.

Figure 4. Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.

ARTEMISIA TRIDENTATA WYOMINGENSIS/AGROPYRON SPICATUM HABITAT TYPE

This is an edaphic climax specific to gravelly soils. The overstory is dominated by Artemisia tridentata wyomingensis that averages 14 inches in height (Figure 4). The understory is dominated by Agropyron spicatum. Other important members of the plant community include Chrysothamnus viscidiflorus var. viscidiflorus, Poa fendleriana and Erigeron engelmanii.

This habitat type occurs at elevations that range from 7500 to 8200 feet. Slopes range from 0 to 65% on primarily south to west facing slopes. This habitat type is usually located on sloping uplands, ridges and gravelly outwash terraces.

Most soils are gravelly as represented by the Quander series, a member of the loamy skeletal, mixed family of Argic Cryoborolls. This is the major soil series that occurs within this habitat type. Other soils include the Bearmouth series which is sandier and the Leavitte and Yovimpa series which contain less gravel. The parent material is usually gravelly outwash terrace or residium for gneiss, granite or sandstone. Geologic formations include Pierre Shale with a sandstone cap, and Boulder Creek granodionite.

The Artemisia tridentata vaseyana/Festuca idahoensis habitat type occurs at higher elevations and in swale positions where soil temperatures are colder and snow accumulation is greater resulting in a more mesic environment. The moisture indicating species such as Lupinus species, and Vicia americana do not usually occur in the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.

Table 10. Cover and frequency data for Artemisia tridentata wyomingensis/Agropyron spicatum stands. Data for each stand are in three columns: mm mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	1			2			3			26			36			40		
GRASSES AND GRASSLIKES																		
Agropyron smithii	.15	(.08)	7							1.06	(.48)	20	.13	(.13)	3	.06	(.06)	3
Agropyron spicatum	16.35	(2.89)	97	.90	(.42)	15	3.15	(.60)	67	6.50	(1.95)	50	13.86	(2.69)	67	11.60	(2.29)	73
Bouteloua gracilis	1.85	(1.06)	15							4.36	(.78)	67	3.13	(1.52)	17			
Carex	1.50	(.84)	7	.35	(.25)	7				.26	(.18)	7						
Koeleria cristata	2.35	(.53)	57	1.80	(.46)	50	3.15	(.64)	57	1.00	(1.00)	3				.50	(.34)	13
Oryzopsis hymenoides													2.00	(1.21)	10			
Poa fendleriana	.30	(.25)	5	5.85	(1.12)	75	2.85	(.67)	42							7.70	(1.35)	77
Poa secunda																.53	(.34)	13
Stipa comata	.35	(.25)	7	.05	(.05)	2				.73	(.46)	10	4.66	(1.61)	37			
Stipa pinetorum	1.15	(.47)	17															
Sitanion hystrix	.10	(.06)	5	.15	(.08)	7	.15	(.08)	7	1.20	(1.00)	10	1.36	(.74)	17			
FORBS																		
Agoseris glauca							.20	(.09)	10									
Artemisia dracunculus													.33	(.33)	3			
Astragalus convallarius	.25	(.10)	12	1.30	(.42)	35	.75	(.27)	27	.30	(.18)	10				1.86	(.79)	27
Erigeron eatonii				.45	(.26)	12	.10	(.06)	5							.06	(.06)	3
Erigeron engelmanii	.25	(.10)	12	.45	(.13)	22	.15	(.08)	7	.16	(.13)	7	.03	(.03)	3	.13	(.09)	7
Eriogonum umbellatum	.85	(.35)	22				.40	(.26)	10				.06	(.06)	3			
Mamillaria vivipara	.40	(.26)	10				.05	(.05)	2	.13	(.10)	7				.20	(.12)	10
Mertensia lanceolata	.10	(.06)	5	2.35	(.48)	67												
Opuntia polyacantha													.13	(.13)	3			
Oxytropis sericea				.30	(.11)	15												
Penstemon caespitosus	.25	(.25)	2															
Phlox bryoides	3.45	(.62)	72				3.35	(.70)	47	2.76	(.65)	57						
Phlox multiflora				4.50	(.72)	55	1.60	(.52)	30							.33	(.33)	3
Physaria sp.																.03	(.03)	3
Sedum stenopetalum				.05	(.05)	2												
Sphaeralcea coccinea										.13	(.09)	7	.06	(.06)	30			
Townsendia sp.										.23	(.14)	10						
Trifolium gymnocarpon				2.10	(.50)	55	.55	(.26)	17							.03	(.03)	3
LICHEN	3.15	(1.01)	80	.85	(.15)	42	.05	(.05)	2	3.30	(.83)	60				1.80	(.73)	43
MOSS	5.00	(1.79)	50													2.86	(.94)	30
SHRUBS																		
Amelanchier alnifolia	.25	(.25)	2															
Artemisia frigida	.30	(.25)	5	.30	(.25)	5				1.50	(.49)	37				.03	(.03)	3
Artemisia tridentata subsp. wyomingensis	17.45	(4.25)	70	15.00	(3.27)	67	14.95	(3.15)	70	22.50	(4.53)	67	26.86	(4.97)	80	25.43	(4.76)	80
Chrysothamnus nauseosus var. glabratus													.13	(.13)	3			
Chrysothamnus parryi var. attenuatus													.66	(.66)	3			
Chrysothamnus viscidiflorus var. viscidiflorus	1.15	(.47)	17	1.80	(.60)	20	.25	(.25)	2	3.76	(1.52)	33	1.46	(1.33)	7	1.43	(.74)	20
Purshia tridentata													2.33	(2.33)	3			
BARE GROUND	41.40	(5.00)	100	59.75	(4.39)	100	73.75	(3.53)	100	59.33	(3.55)	100	56.66	(4.02)	100	46.66	(5.46)	97
LITTER										5.23	(2.03)	83	16.13	(1.77)	100	12.20	(2.33)	100
Total % Cover	57.00	(5.74)		41.97	(4.24)		31.70	(3.58)		49.93	(4.32)		57.60	(5.59)		54.97	(5.60)	
Species Diversity		24			20			17			19			19			20	

Table 11. Abiotic characteristics of the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.

STAND NO.	1	2	3	26	36	40
Date of Sample	9/17/77	8/19/77	6/14/77	7/11/77	7/19/77	7/21/77
LOCATION:						
Quarter	NE,SW	NW,NW	SE,NW	NW,NE	SE,SE	SE,SE
Section	28	17	22	31	10	18
Township	1N	2S	1S	2N	1N	2S
Range	80W	79W	80W	80W	80W	79W
TOPOGRAPHY:						
Slope	5	15	30	13	55	10 21.33
Aspect °Az.	190	310	260	315	65	190 22.67
Position	Upper 1/3	Upper 1/3 Top	Upper 1/3	Upper 1/3	Mid 1/3	Top
Elevation ft.	7600	8200	7850	7900	7600	8100 7975
LAND FORM	Terrace Uplands	Ridgetop Slope Uplands	Slope	Slope Uplands	Slope Uplands	Ridgetop
Soil Temperature °C	19°	15.5°	18°	17°	20.5°	18° 18°
Surface Cobbles & Stones %	25°	15%	45%	30%	20%	20 25.33%
DISTURBANCE:						
Grazing	Slight	Moderate	Moderate	Slight	Severe	Slight
Erosion	Slight	Moderate	Moderate	Moderate	Moderate	Moderate
SSF	41	52	53	40	56	50
Successional Stage	Stable	Stable	Stable	Stable	Stable	Stable
Height of Dominant Layer (inches)	18.86	10.83	17.37	8.87	16.13	10.37

Table 12. Phenological data for important species in the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia tridentata subsp. wyomingensis	3	5			5/15,[1]6/5	6/22,8/9				
Agropyron spicatum	2	5	5/15	6/5		6/22			8/19	
Phlox hoodii	1	4			5/15		6/5 (20%)[2]	6/5(80%), 6/22		
Penstemon caespitosus	1	4			5/15,6/5		6/22		8/19	
Chrysothamnus viscidiflorus	2	3	5/15	6/5			8/19			
Artemisia frigida	2	3			5/15,6/5		8/19			
Koeleria cristata	2	3	5/15		6/5(65%)	6/5(35%)	6/22		8/19	
Bouteloua gracilis	2	3	5/15,6/5		6/22		8/19			
Astragalus convallarius	2	3	5/15			6/5(90%)	6/5 (10%) 6/22 (90%)	6/22(10%)		8/19
Mamillaria vivipara	1	3				5/15		6/5,6/22	8/19	
Eriogonum umbellatum	1	3		5/15,6/5	6/22(90%)		6/22 (10%)		8/19	
Antennaria parvifolia	1	3				5/15,6/5, 6/22(90%)		6/22(10%)	8/19	
Poa fendleriana	2	2						6/22	8/19	
Astragalus shortianus	2	2	5/15	6/5	8/19					
Senecio multilobatus	2	2			5/15,6/5					8/19
Erigeron engelmanii	2	2					5/15,6/5		8/19	
Symphoricarpos oreophilus	3	1	5/15	6/5	6/22					
Amelanchier alnifolia	2	1			6/5,8/19					
Gutierrezia sarothrae	2	1	6/5	6/22			8/19			5/15
Sitanion hystrix	2	1	5/15							
Oryzopsis hymenoides	2	1	5/15							
Stipa comata	2	1							8/19	
Stipa pinetorum	2	1	5/15	6/5	6/22				8/19	
Poa secunda	2	1			8/19		6/22			
Agropyron smithii	2	1	5/15		8/19					
Mertensia lanceolata	2	1				6/5	6/22	8/19		
Taraxacum officinale	2	1							8/19	

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

The Agropyron spicatum/Artemisia frigida habitat type occurs on the windswept ridgetop position often in a complex pattern with this habitat type.

Artemisia tridentata tridentata/Agropyron smithii habitat type occurs on the sandier stream terrace positions and swale positions near intermittent streams at low elevations. Artemisia tridentata wyomingensis/Agropyron smithii habitat type occurs on the deep non-gravelly soils usually developed from the Troublesome Formation. Agropyron spicatum is rarely present.

AGROPYRON SPICATUM/ARTEMISIA FRIGIDA HABITAT TYPE.

This is a topographic climax specific to windswept ridge tops. Most Artemisia tridentata is absent or less than five inches tall when present (Figure 5). The most important species of this community are Agropyron spicatum, Artemisia frigida, Phlox bryoides, Penstemon caespitosus, Erigeron engelmanii, Bouteloua gracilis and lichen.

This habitat type occurs at elevations that range from 7400 to 8200 feet. Slopes range from 0 to 65% mostly on south and west exposures. This habitat type occupies gravelly windblown ridge top positions and windward facing slopes.

The soils within this habitat type are mostly gravelly, as represented by the Rogert series, a member of the loamy-skeletal, mixed family of Lithic Cryoborolls. Quander and Bearmouth series also occur within this habitat type but are also gravelly (skeletal) soils. The parent material is residium from local granite or gneiss rock or cobbly outwash from old river terraces. The geologic formation and materials include Boulder Creek Granodiorite, quartz Monzonite, Middle Park, and hornblende gneiss.

This type is most similar to the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type except that Artemisia is usually absent or when present, it usually grows in a prostrate form rarely reaching a height over 5", always inferior in height to Agropyron spicatum. Sitanion hystrix and Phlox multiflora are usually absent.

Table 13. Cover and frequency data for Agropyron spicatum/Artemisia frigida stands. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	7			11			12			21			24			34		
GRASSES AND GRASSLIKES																		
Agropyron smithii																.66	(.36)	17
Agropyron spicatum	15.97	(2.75)	87	17.93	(2.67)	97	16.86	(2.16)	87	15.23	(2.42)	90	17.56	(2.32)	97	2.46	(.61)	50
Bouteloua gracilis				6.30	(1.65)	57	1.66	(.84)	13				.90	(.47)	17	3.46	(1.29)	27
Carex													.06	(.06)	3	.10	(.05)	10
Koeleria cristata	1.57	(.82)	17				2.70	(.71)	43				1.23	(.56)	17	.23	(.11)	13
Oryzopsis hymenoides				.40	(.33)	7				4.53	(1.69)	30				.30	(.13)	17
Poa fendleriana	.67	(.36)	10				1.66	(.69)	17									
Poa secunda													.13	(.09)	7	.13	(.13)	3
Stipa columbiana	.37	(.16)	12															
Stipa comata	.10	(.10)	2				.23	(.16)	7	.33	(.33)	3						
Stipa pinetorum							1.23	(.49)	23									
FORBS																		
Agoseris glauca	.07	(.07)	2	.13	(.07)	10				.36	(.14)	20	.10	(.10)	3			
Antennaria parvifolia	.25	(.25)	2										.23	(.16)	7			
Artemisia dracunculus										.06	(.06)	3						
Artemisia ludoviciana										2.06	(1.07)	23						
Astragalus convallarius							.70	(.24)	23	.43	(.17)	20	.06	(.06)	3	.06	(.06)	3
Astragalus shortianus			.	.30	(.16)	13				.10	(.10)	3	.26	(.15)	10	.06	(.06)	3
Balsamorhiza sagittata	.65	(.35)	10															
Chaenactis douglasii										.13	(.13)	3						
Chrysopsis villosa				1.96	(1.35)	27				.46	(.35)	7	1.90	(.84)	20			
Commandra umbellata													.06	(.06)	3	.06	(.04)	7
Crepis acuminata	.25	(.11)	12															
Delphinum nelsonii										3.00	(.80)	37						
Erigeron compositus													4.30	(.67)	90			
Erigeron eatonii	.05	(.05)	2															
Erigeron engelmanii	.12	(.06)	10	.13	(.09)	7	.50	(.19)	20				1.06	(.22)	53	.13	(.06)	13
Eriogonum breviscale																1.00	(.73)	7
Eriogonum umbellatum							.06	(.06)	3									
Haplopappus nuttallii				1.33	(.56)	23				.13	(.13)	3				3.46	(.76)	80
Hymenopappus filifolius				1.10	(.48)	27				.20	(.14)	7				3.23	(.86)	60
Lappula sp.				.16	(.11)	7												
Linum lewisii										1.20	(.47)	33	.10	(.10)	3			

Table 13. Continued.

Mertensia ciliata	.05	(.05)	2							.06	(.06)	3					
Mertensia lanceolata	.30	(.12)	15	1.16	(.47)	27				.06	(.06)	3					
Opuntia polyacantha				.33	(.33)	3											
Oxytropis sericea				.03	(.03)	3											
Penstemon caespitosus	2.52	(.58)	50				1.50	(.25)	60				.86	(.67)	10	4.83	(1.06)	80
Penstemon strictus				.10	(.10)	3											
Phlox bryoides	3.17	(.62)	57	4.76	(.88)	73	11.16	(1.02)	97				2.73	(.61)	53	4.20	(.65)	80
Phlox multiflora																.03	(.03)	3
Phlox sp.													2.96	(.94)	33			
Physaria acutifolia										.26	(.15)	10						
Physaria sp.	.07	(.05)	5															
Potentilla concinna													.13	(.13)	3			
Potentilla hippiana				.73	(.37)	17				.10	(.10)	3						
Senecio canus										.10	(.07)	7	.13	(.09)	7	.10	(.07)	7
Senecio multilobatus	.17	(.10)	7													.06	(.06)	3
Townsendia sp.																.16	(.08)	13
Tryfolium gymnocarpon							.33	(.17)	13									
LICHEN	.40	(.08)	37				3.26	(.47)	87	.43	(.17)	20	1.96	(.36)	80	4.80	(.81)	93
MOSS													1.16	(.49)	20	.33	(.33)	3
MUSTARD	.02	(.02)	2															
OTHER FORBS	.35	(.15)	12															
SHRUBS																		
Artemisia frigida	.87	(.30)	27	1.16	(.55)	23	1.13	(.39)	33	2.53	(.77)	30	3.16	(.58)	70	.66	(.23)	23
Artemisia tridentata subsp. wyomingensis	6.12	(1.57)	45				4.46	(2.10)	37									
Chrysothamnus parryi var. attenuatus				3.00	(1.42)	23				6.43	(2.03)	47	3.80	(2.64)	10	.33	(.33)	3
Chrysothamnus viscidiflorus var. viscidiflorus	3.20	(.72)	40							2.33	(1.41)	13	1.46	(.74)	20			
Gutierrezia sarothrae							7.70	(1.74)	57							3.73	(.75)	67
Tetradymia canescens																.46	(.35)	7
BARE GROUND	59.50	(3.28)	97	69.33	(2.66)	100	54.00	(2.47)	100	67.33	(3.14)	100	59.33	(2.62)	100	69.66	(2.73)	100
LITTER				3.70	(.69)	70	2.80	(.52)	73	6.23	(.98)	90	1.73	(.16)	97	1.16	(.15)	80
Total % Cover	37.37	(2.57)		41.07	(2.64)		55.20	(3.07)		41.40	(3.61)		46.40	(3.83)		35.43	(2.99)	
Species Diversity		24			20			18			26			26			29	

Table 14. Abiotic characteristics of the Agropyron spicatum/Artemisia frigida habitat type.

STAND NO.	7	11	12	21	24	34
Date of Sample	6/16/77	6/27/77	6/27/77	7/7/77	7/8/77	7/14/77
LOCATION:						
Quarter	NE,SW	NE,NW	NE,NE	NW,SW	NE,NE	SE,NE
Section	7	15	18	27	11	31
Township	1N	1N	1N	1N	1N	1N
Range	78W	80W	78W	80W	79W	80W
TOPOGRAPHY:						
Slope %	25	50	30	30	25	35 32.50
Aspect °Az.	110	190	180	210	265	195 191.67
Position	Top	Upper 1/3	Upper 1/3	Upper 1/3	Upper 1/3	Upper 1/3
Elevation	8200	7600	7800	8200	7900	7840 7923.33
LAND FORM	Ridgetop	Ridgetop Slope	Ridgetop Slope	Ridgetop Slope	Ridgetop	Ridgetop Slope
Soil Temperature °C	17.5°	20.5°	23°	20°	21°	19° 20.17°
Surface Cobbles & Stones %	25	25	25	20	20	35 25%
DISTURBANCE:						
Grazing	Moderate	Slight	Slight	Moderate	Moderate	Moderate
Erosion	Moderate	Slight	Slight	Moderate	Moderate	Moderate
SSF	41	40	39	42	43	38
Successional Stage	Stable	Stable	Stable	Stable	Stable	Stable
Height of Dominant Layer (inches)	5.3	14	4.4			

Table 15. Phenological data for important species in the Agropyron spicatum/Artemisia frigida habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Gutierrezia sarothrae	2	4	5/11[1]	6/8	6/20	7/14(95%)[2]	7/14(5%)			
Agropyron spicatum	2	4	5/11	6/8	6/21,7/14					
Phlox bryoides	1	4						6/8,6/21	7/14	5/11
Penstemon caespitosus	1	4		5/11,6/8	6/20(75%)		6/20 (25%)		7/14	
Hymenopappus filifolius	2	3	5/11		6/8(70%), 6/20(65%)	6/8(30%)	6/20 (35%)	7/14		
Haplopappus nuttallii	2	3	6/8		6/21(90%)	6/21(10%)		7/14		
Senecio canus	2	3	6/8		6/21				7/14(50%)	7/14(50%)
Artemisia frigida	2	2	6/8		6/20,7/14					
Chrysothamnus parryi var. attenuatus	2	2	5/11	6/8,6/21,7/14						
Koeleria cristata	2	2	5/11,6/8				6/21	7/14		
Bouteloua gracilis	2	2	6/8	6/20				7/14		
Commandra umbellata	2	2				5/11,6/20, 7/14				
Juniperus scopulorum	2	1			6/21					
Tetradymia canescens	2	1	5/11	6/8						
Artemisia tridentata subsp. wyomingensis	2	1			5/11,6/20,7/14 (95%)	7/14(5%)				
Agropyron smithii	2	1		5/11,6/8	6/21,7/14(75%)	7/14(25%)				
Carex sp.	2	1	6/8		7/14					
Oryzopsis hymenoides	2	1			6/20,7/14					
Streptanthus cordatus	2	1	5/11	6/8	6/21					
Haplopappus armeroides	2	1		5/11	6/8(65%)		6/8 (35%)	6/21	7/14	
Eriogonum brevicaule	2	1			6/8(65%)	6/8(35%)	6/21	7/14		
Senecio multilobatus	2	1	6/8							7/14
Townsendia sp.	2	1	3/30					6/8,6/21, 7/14		
Mertensia lanceolata	2	1						6/21		7/14
Sphaeralcea coccinea	2	1			6/21,7/14					

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Figure 5. Agropyron spicatum/Artemisia frigida habitat type.

Figure 6. Juniperus scopulorum/Agropyron spicatum habitat type.

JUNIPERUS SCOPULORUM/AGROPYRON SPICATUM HABITAT TYPE

This is an edaphic climax specific to cobbly and stony soils with extensive areas of rock outcropping (Figure 6). Some of the most important species in the plant association include Oryzopsis hymenoides, Carex sp., Mertensia lanceolata, Sitanion hystrix, Artemisia tridentata subsp. wyomingensis and Bouteloua gracilis.

This habitat type occurs at elevations that range from 7600 to 8300 feet. Slopes range from 35 to 70% with mostly south and west facing exposures. This habitat type occupies steep rocky and stony ridges and mountain slopes. Bare ground or rock cover over 65% of the area. Runoff from rocky areas increases the effective moisture in surrounding areas where moisture loving species may be found.

The major soils that occur are Cryoborolls and rock outcrops. The parent material is usually gneiss or granidiorite residium and alluvium, from Boulder Creek Granodiorite, biotite gneiss or quartz monzonite geologic material.

The Amelanchier alnifolia/Agropyron spicatum habitat type is very similar except for the exclusion of Juniperus scopulorum, Bouteloua gracilis, Carex sp., and Sitanion hystrix. It is more specific to stony, alluvial slopes with less rock outcroppings.

Much of the Juniperus scopulorum/Agropyron spicatum habitat type has been disturbed by fire and heavily browsed by deer.

Table 16. Cover and frequency data for Juniperus scopulorum/Agropyron spicatum stands. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	6			14			16			27			29			41		
GRASSES AND GRASSLIKES																		
Agropyron spicatum	12.85	(2.61)	67	4.20	(2.11)	23	8.73	(2.87)	57	5.90	(2.64)	30	5.06	(1.99)	37	7.90	(2.48)	53
Bouteloua gracilis	.50	(.50)	2	2.00	(1.00)	13	.13	(.13)	3				.06	(.06)	3	.66	(.46)	7
Bromus tectorum	.65	(.50)	12															
Carex	.10	(.10)	2	4.20	(1.69)	27	8.16	(1.79)	60	5.53	(2.77)	27				3.20	(.80)	40
Festuca idahoensis							.33	(.33)	3									
Koeleria cristata	.07	(.05)	5				.56	(.34)	17	1.13	(.56)	13				.33	(.33)	3
Oryzopsis hymenoides	1.95	(1.06)	15	1.23	(1.00)	13	1.73	(.96)	13	2.40	(1.23)	17	8.36	(2.98)	47	.06	(.06)	3
Oryzopsis micrantha				.13	(.09)	7										3.66	(1.76)	17
Poa fendleriana	1.27	(.45)	22	1.36	(.79)	13	5.60	(1.47)	43							.36	(.20)	10
Poa secunda																.86	(.46)	17
Poa spp.										.33	(.33)	3						
Stipa pinetorum	.25	(.14)	7	.13	(.09)	7										.26	(.18)	7
Sitanion hystrix	.95	(.38)	20	.56	(.35)	13	.03	(.03)	3	2.36	(1.20)	23	2.33	(1.70)	10	.13	(.13)	3
FORBS																		
Antennaria parvifolia				.33	(.33)	3				.06	(.06)	3						
Androsace septentrionalis																.13	(.13)	3
Astragalus convallarius							.03	(.03)	3	.13	(.13)	3						
Balsamorhiza sagittata							1.00	(.55)	10									
Chenopodium spp.	.05	(.05)	2													.03	(.03)	3
Chrysopsis villosa							.46	(.34)	10									
Commandra umbellata										.13	(.13)	3						
Crepis acuminata										.13	(.13)	3						
Descrania richardsonii	.07	(.07)	2				.06	(.06)	3							.23	(.16)	7
Erigeron eatonii							.03	(.03)	3									
Heuchera parvifolia	.17	(.12)	5				.10	(.10)	3									
Linum lewisii							.03	(.03)	3									
Mertensia ciliata	.10	(.05)	7													.03	(.03)	3
Mertensia lanceolata	1.97	(.49)	42	1.86	(.69)	23	1.06	(.47)	23	.23	(.14)	10				1.36	(.49)	33
Opuntia polyacantha				1.66	(1.66)	3										.36	(.33)	7

Table 16. Continued

Penstemon caespitosus									.13	(.13)	3					
Penstemon watsoni				.53	(.34)	13	.03	(.03)	3							
Phlox bryoides	.17	(.12)	5													
Potentilla concinna				.73	(.66)	7	1.10	(.73)	10						.33	(.33)	3
Senecio multilobatus	.35	(.14)	15	.33	(.33)	3	.03	(.03)	3	.03	(.03)	3			.50	(.34)	10
LICHEN	1.22	(.39)	30							.13	(.09)	7	.33	(.33)	3	.50	(.35)	10
MOSS				.33	(.33)	3	1.06	(.99)	7	.13	(.13)	3				3.80	(1.79)	33
MUSTARD				.53	(35)	10												
OTHER FORBS	.10	(.06)	5	.20	(.11)	13							.23	(.16)	7	.10	(.05)	10
SHRUBS																		
Artemisia frigida				.50	(.34)	10												
Artemisia tridentata subsp. wyomingensis				6.46	(3.15)	27	3.13	(1.73)	13	11.30	(3.33)	53	.10	(.10)	3	6.60	(2.45)	30
Chrysothamnus parryi var. attenuatus	.25	(.25)	2							.66	(.66)	3	.36	(.33)	7			
Chrysothamnus viscidiflorus var. viscidiflorus													.33	(.33)	3			
Juniperus scopulorum	27.55	(5.59)	57	27.93	(5.81)	60	23.33	(5.74)	50	23.00	(5.65)	50	16.33	(5.24)	30	19.26	(5.63)	47
Purshia tridentata							.50	(.35)	10							.66	(.66)	3
Ribes cereum				2.40	(1.23)	17	1.73	(1.18)	10				.10	(.10)	3	.03	(.03)	3
Symphoricarpos oreophilus							.03	(.03)	3	1.00	(1.00)	3						
BARE GROUND	76.55	(2.92)		70.40	(4.87)		61.80	(4.67)		66.73	(4.80)		82.66	(3.25)		68.53	(4.43)	
Total % Cover	50.62	(5.62)		57.67	(7.12)		60.03	(5.87)		54.87	(8.04)		33.63	(6.21)		51.57	(7.13)	
Species Diversity		20			22			28			19			12			26	

Table 17. Abiotic characteristics of the Juniperus scopulorum/Agropyron spicatum habitat type.

STAND NO.	6	14	16	27	29	41
Date of Sample	6/16/77	6/29/77	6/29/77	7/12/77	7/12/77	7/22/77
LOCATION:						
Quarter	NE,SW	NW,SE	SE,NE	SE,SE	SW,SE	SE,NW
Section	7	22	21	30	30	17
Township	1N	1N	1N	2N	2N	1N
Range	78W	79W	79W	80W	80W	79W
TOPOGRAPHY:						
Slope %	45	40	50	45	70	50
Aspect °Az.	220	180	280	225	155	244
Position	Upper 1/3	Mid 1/3	Mid 1/3	Mid 1/3	Mid 1/3	Upper 1/3
Elevation	7800	8000	7800	8250	8300	7760
LAND FORM	Slope	Slope Uplands	Slope	Slope Uplands	Slope Uplands	Slope
Soil Temperature °C	16.5°	15.5°	14°	14°	18°	15.5°
Surface Cobbles & Stones %	40	50	25	25	50	25
DISTURBANCE:						
Grazing	Moderate	Moderate	Slight	Moderate	Moderate	Moderate
Erosion	Moderate	Moderete	Slight	Moderate	Moderate	Moderate
SSF	59-Mod.	50-Mod.	46-Mod.	49-Mod.	53-Mod.	59-Mod.
Successional Stage	Stable	Stable	Stable	Stable	Stable	Late Seral
Height of Dominant Layer (inches)	96	216	180	132	120	120

Table 18. Phenological data for important species in the Juniperus scopulorum/Agropyron spicatum habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Juniperus scopulorum	4	5						6/21(90%)[2] 7/22(65%)	6/21(10%) 7/22(35%)	
Agropyron spicatum	2	5		5/15	6/6(90%)	6/6(10%) 6/21(50%)	6/21 6/20 (50%)	7/22		
Bouteloua gracilis	2	4		6/6	6/21(90%)	6/21(10%)	7/22 (65%)	7/22(35%)		
Artemisia tridentata subsp. wyomingensis	3	3				6/21/22				
Artemisia frigida	2	3			5/15,6/6	6/21,7/22				
Chrysothamnus parryi var. attenuatus	2	3		5/15	6/6,6/21, 7/22(50%)	7/22(50%)				
Oryzopsis micrantha	2	3				7/22				
Oryzopsis hymenoides	2	3		5/15	6/6	6/21		7/22		
Hertensia lanceolata	2	3				5/15,6/21 (10%)	6/6, 6/21(90%)	7/22(50%)	7/22(50%)	
Senecio multilobatus	1	3			5/15(35%)	5/15(35%)	5/15(30%) 6/21		7/22	
Opuntia polyacantha	1	3			5/15	6/6	6/21, 7/22(10%)	7/22(90%)		
Poe fendleriana	2	2				5/15(50%)	5/15 (50%), 6/6	6/21	7/22	
Carex sp.	2	2		5/15,6/6	6/21					
Erigeron engelmanii	2	2					6/6,6/21		7/22	
Chrysopsis villosa	2	2			6/6(90%)		6/6(10%), 6/21,7/22			
Phlox bryoides	1	2					6/6,6/21	7/22	7/22	
Purshia tridentata	3	1	5/15	6/6			6/21	7/22		
Ribes cereum	3	1		5/15	6/6,6/21			7/22		
Rhus trilobata	3	1			6/6					
Chrysothamnus viscidiflorus	3	1					7/22			
Sitanion hystrix	2	1				6/21			7/22	
Physaria acutifolia	2	1					5/15			7/22
Eriogonum umbellatum	1	1			6/6(90%)		6/6(10%)		7/22	
Penstemon caespitosus				5/15			6/6,6/21 (50%)	6/21(50%)	7/22	

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

ARTEMISIA TRIDENTATA VASEYANA/FESTUCA IDAHOENSIS HABITAT TYPE.

This is a climatic climax characterized by a dense overstory of Artemisia tridentata vaseyana that averages 23 inches in height (Figure 7). The asscciated understory includes a number of moisture indicating species that comprises the Festuca idahoensis union. Members of this union include Festuca idahoensis, Carex sp., Lupinus spp., Castilleja flava, Taraxacum officinale, Huechera parvifolia, Clematis hirsutissina, Vicia americana, Potentilla hippiana, Androsace septentrionalis, and Symphoricarpos oreophilus. Chrysothamnus viscidiflorus var. viscidiflorus, Mertensia lanceolata, Poa fendleriana, and Trifolium gymnocarpon are important species but are not included as members of the Festuca idahoensis union. Not all members of the union, including Festuca idahoensis need to be present but at least five species should be represented. Heavy grazing may reduce the understory species composition to a dominance of Poa fendleriana or Sitanion hystrix, as is the case for the heavily grazed stand 13.

This habitat type occurs at elevations that range from 7700 to 8800 feet. Slopes range from 0 to 20% at lower elevations with mostly north to east facing slopes. At higher elevations this habitat type is usually on steeper south and west facing slopes. It occupies swale positions and shallow depth snow drift areas at the lower elevations but occupies plateaus in deep soils as a climatic climax at the higher elevations.

The major soils that occur within this habitat type are represented by Leavitte loam, a member of the fine-loamy mixed family of Argic Cryoborolls. The Quander soil series also occurs within this habitat type at the higher elevations. Quander soils are more gravelly than Leavitt soils. The parent material is usually local loess over decomposed shale bedrock from the Pierre Shale of Late Cretaceous age.

The Artemisia tridentata wyomingensis/Agropyron spicatum habitat type occurs near this type on the dryer gravelly soils at the lower elevations. In a complex micro-relief pattern of undulating topography Artemisia tridentata, wyomingensis occurs on the convex positions while Artemisia tridentata, vaseyana occurs in the concave depressions. Members of the Festuca idahoensis union are usually absent from the Artemisia tridentata, wyomingensis habitat types especially Festuca idahoensis, Lupinus spp., Castilleja flava, and Symphoricarpos oreophilus. Amelanchier alnifolia/Carex has a similar soil, however, it is restricted to areas of deep snow drift accumulation.

Figure 7. Artemisia tridentata vasevana/Festuca idahoensis habitat type.

Figure 8. Amelanchier alnifolia/Agropyron spicatum habitat type.

Table 19. Cover and frequency data for Artemisia tridentata vaseyana/Festuca idahoensis stands. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	8			9			13			15			39			42			
GRASSES AND GRASSLIKES																			
Agropyron smithii																2.96	(.68)	67	
Agropyron spicatum	.17	(.08)	10	.55	(.35)	1	.53	(.35)	10	.56	(.35)	13				.20	(.14)	6	
Agropyron spp.													2.13	(.82)	43				
Bromus spp.	2.40	(.72)	33										2.20	(.62)	47	.06	(.06)	3	
Carex	1.52	(.49)	28	1.95	(.67)	28				1.33	(1.33)	3	15.23	(2.42)	93	.16	(.10)	10	
Carex spp.	.50	(.34)	5													.10	(.10)	3	
Festuca idahoensis	3.30	(.59)	58	5.32	(1.21)	45				5.80	(1.19)	57	.50	(.35)	10				
Koeleria cristata	3.35	(.77)	45	.32	(.25)	5				5.43	(1.32)	63	.13	(.13)	3	1.26	(.50)	23	
Oryzopsis hymenoides							.06	(.06)	3										
Poa fendleriana	4.85	(.79)	60	8.72	(1.37)	68	.33	(.33)	3	16.26	(2.58)	90	.83	(.46)	17	13.10	(2.49)	70	
Poa nevadensis																1.80	(1.17)	13	
Poa pratensis													.03	(.03)	3				
Poa spp.	.10	(.10)	2																
Sitanion hystrix				.45	(.17)	18	4.86	(1.05)	63	.23	(.16)	7				.10	(.10)	3	
Stipa pinetorum							3.10	(1.44)	17	4.00	(1.16)	47				2.13	(.69)	30	
FORBS																			
Agoseris glauca	.12	(.10)	5																
Androsace septentrionalis	.47	(.27)	13	.05	(.05)	3													
Antennaria parvifolia	1.65	(.67)	18	.77	(.36)	15				1.66	(.79)	23	.06	(.06)	3	.13	(.13)	3	
Astragalus convallarius	.62	(.29)	15	3.22	(1.10)	38													
Castilleja flava				.82	(.37)	15				.13	(.10)	7							
Chrysopsis villosa	.02	(.02)	3																
Clematis hirsutissima	1.75	(.79)	13										.03	(.03)	3				
Crepis acuminata													.13	(.13)	3				
Erigeron eatonii				.15	(.11)	5							.13	(.13)	3				
Erigeron engelmanii	.02	(.02)	3	.35	(.25)	8				.50	(.19)	23							
Erigeron speciosus				.05	(.05)	3													
Eriogonum umbellatum	8.72	(2.31)	50	2.00	(2.00)	3	1.56	(.79)	17	1.83	(.49)	50	5.36	(2.65)	20	.20	(.14)	7	
Haplopappus armeroides	.25	(.25)	3																
Heuchera parvifolia	1.00	(.43)	15																
Lupinus ammophilus	.10	(.10)	3	10.67	(2.47)	68							3.33	(1.00)	47				
Lupinus greenii	2.97	(.91)	35	.10	(.10)	3													

Table 19. Continued

Mertensia lanceolata	6.72	(.66)	95	4.20	(.67)	80	.33	(.17)	13	1.23	(.45)	30	6.66	(1.17)	87	1.60	(.62)	27
Penstemon watsoni				.40	(.26)	8							.03	(.03)	3	.06	(.04)	7
Penstemon caespitosus							2.80	(1.23)	27							1.50	(1.33)	13
Phlox bryoides							.13	(.13)	3							.16	(.09)	10
Phlox multiflora	2.35	(.59)	38	1.40	(.45)	25				3.76	(.69)	67	1.46	(.74)	23			
Physaria acutifolia	.12	(.08)	5	.07	(.05)	5												
Physaria sp.	.17	(.11)	8	.15	(.10)	8							.33	(.33)	3			
Potentilla concinna	.25	(.25)	3															
Potentilla hippiana	.70	(.36)	10							.83	(.37)	23						
Senecio multilobatus				.05	(.05)	3												
Taraxacum officinale	.32	(.13)	18	.22	(.11)	10							.06	(.06)	3			
Tryfolium gymnocarpon	.65	(.29)	15	.65	(.35)	13	.10	(.07)	7	.60	(.17)	37						
Vicia americana	1.00	(1.00)	3										2.06	(1.08)	20			
LICHEN				.07	(.05)	5	.06	(.04)	7	1.56	(.46)	53				.43	(.33)	10
MOSS				1.35	(.73)	10							1.66	(1.66)	3	.33	(.33)	3
MUSTARD													.16	(.13)	7			
OTHER FORBS	4.37	(1.35)	40	.07	(.05)	5							.30	(.12)	20			
SHRUBS																		
Artemisia frigida										.33	(.33)	3						
Artemisia tridentata subsp. vaseyana	22.97	(2.99)	85	27.75	(3.72)	90	32.73	(4.28)	87	11.36	(3.10)	63	31.26	(4.31)	100	21.23	(3.86)	93
Chrysothamnus nauseosus var. glabratus	1.35	(.89)	8															
Chrysothamnus viscidiflorus var. viscidiflorus	6.72	(1.86)	48	2.40	(.81)	28	.40	(.33)	7	5.13	(2.36)	47	1.83	(.79)	27	2.86	(1.12)	30
Symphoricarpos oreophilus	.75	(.42)	8	.27	(.25)	5	.66	(.66)	3			.1	.16	(.13)	7	1.90	(.83)	23
BARE GROUND	13.02	(1.97)	98	16.27	(2.76)	88	64.06	(3.71)	100	33.46	(3.68)	100	10.93	(3.30)	60	31.13	(4.09)	100
LITTER							11.56	(1.66)	100	9.66	(1.02)	97	27.00	(3.00)	100	15.73	(2.40)	97
Total % Cover	82.40	(4.66)		74.60	(4.97)		47.70	(4.48)		62.60	(3.12)		76.17	(6.88)		52.33	(4.48)	
Species Diversity		34			31			16			21			27			23	

Table 21. Phenological data for important species in the Artemisia tridentata vaseyana/Festuca idahoensis habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia tridentata subsp. vaseyana	3	5			5/15,6/8[1]	6/20,7/21				
Poa fendleriana	2	4			5/15		6/8,6/20 (50%)[2]	6/20(50%)	7/21	
Lupinus ammophilus	2	4		5/15	6/8(50%), 6/20(50%)		6/8(50%)	6/20(50%)		7/21
Symphoricarpos oreophilus	2	3		5/15	6/8		6/20	7/21(50%)	7/21(50%)	
Chrysothamnus viscidiflorus	2	3	5/15		6/8,6/20	7/21				
Capsella bursa-pastoris	2	3					5/15	6/8		7/21
Cryptantha sericea	2	3			5/15			6/8,6/10		7/21
Mertensia lanceolata	2	3					5/15	6/8,6/20	7/21(50%)	7/21(50%)
Antennaria parvifolia	1	3			5/15	6/8	6/20	7/21		
Festuca idahoensis	2	2	5/15			6/8	6/20	7/21		
Astragalus convallarius	2	2					6/8	6/20,7/21		
Penstemon watsonii	2	2		5/15	6/8,6/20 (50%)	6/20(50%)		7/20		
Erigeron eatonii	2	2					5/15,6/20 (50%)	6/20(50%)		7/21
Taraxacum officinale	2	2			5/15		6/8,6/20 (35%)	6/20(65%)		7/21
Senecio multilobatus	2	2			5/15(50%)	5/15(50%)	6/8	6/20		7/21
Castilleja flava	2	2			6/8	6/20	7/20			
Bromus sp.	2	1			7/21					
Sitanion hystrix	2	1				6/20,7/21 (50%)	7/21(50%)			
Balsamorhiza sagittata	2	1						7/21		
Trifolium gymnocarpon	2	1			6/8,6/20					
Eriogonum umbellatum	2	1			6/8		6/20	7/21		
Androsace septentrionalis	2	1					5/15	6/20		7/21

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Table 20. Abiotic characteristics of the Artemisia tridentata vaseyana/Festuca idahoensis habitat type.

STAND NO.	8	9	13	16	39	42
Date of Sample	6/17/77	6/20/77	6/27/77	6/29/77	7/21/77	7/26/77
LOCATION:						
Quarter	NW,NE	NE,SW	NE,NE	SE,NW	SE,NE	NW,SE
Section	18	17	18	22	17	2
Township	2S	2S	1N	1N	2S	1N
Range	79W	79W	78W	79W	79W	79W
TOPOGRAPHY:						
Slope %	20	7	10	4	15	10
Aspect °Az.	300	235	125	170	260	85
Position	Lower 1/3	Upper 1/3	Mid 1/3	Top	Bottom	Bottom
Elevation	8200	8350	7840	8300	8700	7760
LAND FORM	Slope	Slope	Plateau	Ridgetop Uplands	Plateau	Bottom Uplands
Soil Temperature °C	12°	12°	19.5°	20°	11.5°	17°
Surface Cobbles & Stones %	10	1	2	5	-	-
DISTURBANCE:						
Grazing	Severe	Moderate	Moderate	Moderate	Moderate	Moderate
Erosion	Moderate	Slight	Moderate	Slight	Slight	Moderate
SSF			54	36	20	48
Successional Stage	Stable	Stable	Late Seral	Stable	Stable	Stable
Height of Dominant Layer (inches)	26.6	29.0	15.5	14.27	26.93	23.17

AMELANCHIER ALNIFOLIA/AGROPYRON SPICATUM HABITAT TYPE

This is an edaphic climax specific to cobbly and stony soils. Amelanchier alnifolia dominates the overstory canopy averaging 53 inches in height. The associated understory is dominated by Agropyron spicatum. Other important members of the association include Symphoricarpos oreophilus, Chrysothamnus parryi var. attenuatus, Oryzopsis hymenoides and Delphinum occidentale (Figure 8).

This habitat type occurs at elevations from 7900 to 8600 feet. Slopes range from 30 to 70% primarily on south and west facing exposures. It occupies steep cobbly and gravelly mountain slopes. About 50% of the ground surface is bare ground.

The major soil that occurs within this unit is represented by Rogert gravelly sandy loam, a member of the loamy-skeletal mixed family of Lithic Cryoborolls. Although the representative profile is lithic much of the soil is deeper than 20" to hard bedrock. The parent material is mostly Colluvium from Boulder Creek Granodiorite of Precambrian age.

The Juniperus scopulorum/Agropyron spicatum habitat type is the most similar but occupies rockier residual soil material as compared to the cobbly colluvium occupied by Amelanchier alnifolia/Agropyron spicatum habitat type in that the former has deep Mollic soils, very few cobbles or stones, a continuous ground cover, and occupies moist snow drift areas.

Not only Juniperus but also Carex, Bouteloua gracilis and Sitanion hystrix are absent from the Amelanchier alnifolia/Agropyron spicatum habitat type. The Amelanchier alnifolia/Carex habitat type differs greatly from the Amelanchier alnifolia/Agropyron spicatum habitat type in that the former has deep Mollic soils, very few cobbles or stones, a continuous ground cover, and occupies moist snow drift areas. Species diversity is much higher including moisture loving species as Carex, Festuca idahoensis, Erigeron speciosus, Galium boreale, Heuchera parvifolia, and Lupinus spp.

Aspen occupy sites where increased elevation or a change in relief would allow greater snow accumulation. Douglas-fir forest occurs on gravelly sites similar to the Amelanchier alnifolia/ Agropyron spicatum habitat type but at higher elevations or north facing slopes.

Table 22. Cover and frequency data for Amelanchier alnifolia/Agropyron spicatum stands. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	5			20			30			31			32			38		
GRASSES AND GRASSLIKES																		
Agropyron smithii										1.00	(.55)	10						
Agropyron spicatum	16.25	(2.72)	85	7.23	(2.52)	37	22.10	(4.65)	90	21.66	(3.06)	90	17.53	(3.05)	90	20.53	(4.18)	67
Koeleria cristata													.10	(.07)	7			
Oryzopsis hymenoides				1.33	(.56)	23	5.50	(1.74)	47	2.63	(1.13)	27	1.83	(.96)	17			
Poa fendleriana													.66	(.66)	3	.06	(.06)	3
FORBS																		
Agoseris glauca				.20	(.10)	13												
Artemisia ludoviciana										.33	(.33)	3	.13	(.13)	3			
Astragalus convallarius	.20	(.11)	8	.10	(.07)	7				.06	(.04)	7	.36	(.33)	7			
Astragalus shortianus				.13	(.13)	3												
Balsamorhiza sagittata	.15	(.11)	5															
Castilleja flava	.85	(.37)	15							.23	(.16)	7	1.10	(.73)	10			
Chaenactis douglasii													.16	(.09)	10	.06	(.06)	3
Crepis acuminata							.06	(.06)	3							.13	(.13)	3
Cryptantha sericea				.16	(.13)	7										.13	(.13)	3
Delphinum nelsonii	.10	(.10)	100	1.26	(.56)	23										.43	(.34)	7
Delphinum occidentale							.96	(.48)	17	1.43	(.57)	23	1.83	(.63)	30	3.00	(1.05)	30
Erigeron engelmanii																.06	(.06)	3
Eriogonum umbellatum	1.67	(1.04)	13															
Euphorbia robusta													.13	(.13)	3			
Gilia candida				.03	(.03)	3							.10	(.07)	7			
Linum lewisii	.07	(.07)	3							.33	(.33)	3	.36	(.33)	7			
Lupinus ammophilus													1.63	(1.33)	13			
Mertensia ciliata							.06	(.06)	3				.03	(.03)	3			
Mertensia lanceolata							.03	(.03)	3	.20	(.12)	10	.20	(.14)	7			
Penstemon strictus				.03	(.03)	3												
Physaria sp.				.13	(.13)	3							.16	(.10)	10	.33	(.33)	3
Senecio canus				.03	(.03)	3							.10	(.10)	3			

Table 22. Continued

Taraxacum officinale	.37	(.25)	10												.33	(.33)	3
LICHEN													.06	(.04)	7		
MOSS													.06	(.06)	3		
OTHER FORBS													1.16	(.56)	17		
SHRUBS																	
Amelanchier alnifolia	22.97	(4.81)	58	16.06	(5.51)	33	22.70	(6.33)	47	15.73	(5.66)	37	12.66	(5.14)	27	4.80	(2.69)	17
Artemisia frigida							.06	(.06)	3	1.13	(.73)	13				.33	(.33)	3
Artemisia tridentata subsp. wyomingensis	1.00	(1.00)	3				9.16	(3.52)	37				4.43	(2.37)	20			
Cercocarpus montanus	8.10	(2.79)	30				.13	(.13)	3									
Chrysothamnus parryi var. attenuatus	.75	(.75)	3	3.16	(1.73)	17				.66	(.66)	3	1.26	(1.00)	10			
Chrysothamnus viscidiflorus var. viscidiflorus	.40	(.26)	8				1.00	(1.00)	3									
Prunus virginiana	5.47	(1.77)	30															
Purshia tridentata										3.76	(1.68)	20	.13	(.13)	3			
Rhus trilobata																2.66	(2.66)	3
Ribes cereum	.85	(.55)	8													.06	(.06)	3
Symphoricarpos oreophilus	9.72	(2.02)	58	1.00	(1.00)	3	.13	(.13)	3	6.50	(2.15)	37	3.43	(1.50)	33	3.13	(1.27)	23
BARE GROUND	14.35	(3.51)	50	83.06	(3.53)	100	47.23	(5.79)	97	51.30	(4.77)	97	52.96	(4.71)	100	69.00	(5.42)	100
LITTER	28.05	(5.53)	50	6.53	(1.39)	80	11.80	(2.44)	97	10.53	(1.46)	93	8.36	(1.43)	87	5.50	(1.52)	87
Total % Cover	68.95	(5.97)		30.93	(6.16)		61.93	(5.42)		55.70	(5.55)		49.70	(5.40)		44.17	(7.12)	
Species Diversity		18			17			14			16			27			18	

Table 23. Abiotic characteristics of the Amelanchier alnifolia/Agropyron spicatum habitat type.

STAND NO.	5	20	30	31	32	38
Date of Sample	6/18/77	7/7/77	7/13/77	7/13/77	7/13/77	7/20/77
LOCATION:						
Quarter	NW,SE	NE,SW	SE,NW	NE,NE	NW,NW	SW,NE
Section	35	27	27	28	27	28
Township	1S	1N	1N	1N	1N	1N
Range	80W	80W	80W	80W	80W	80W
TOPOGRAPHY:						
Slope %	65	70	60	45	44	65
Aspect °Az.	325	190	95	170	240	265
Position	Upper 1/3	Mid 1/3	Mid 1/3	Mid 1/3	Mid 1/3	Upper 1/3
Elevation	8000	8200	8200	8480	8300	8500
LAND FORM	Slope	Slope	Slope Uplands	Slope Uplands	Slope Uplands	Slope
Soil Temperature °C	16°C	18°	18°	16°	18°	14.5°
Surface Cobbles & Stones %	5	60	4	10	35	40
DISTURBANCE:						
Grazing	Moderate	Moderate	Slight	Slight	Moderate	Slight
Erosion	Severe	Moderate	Moderate	Moderate	Moderate	Moderate
SSF	61	54	52	46	47	51
Successional Stage	Stable	Climax	Stable	Stable	Stable	Stable
Height of Dominant Layer (inches)	38.7	60	55	48	58	60

Table 24. Phenological data for important species in the Amelanchier alnifolia/Agropyron spicatum habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Amelanchier alnifolia	4	5				5/16[1],6/5 (25%)[2]	6/5(75%)		6/22,7/20	
Agropyron spicatum	3	5		5/16,6/5 (25%)	6/5(75%)	6/22	7/20			
Delphinum nelsonii	2	4			5/16	6/5	6/22(10%)	6/22(90%)		7/20
Chrysothamnus parryi var. attenuatus	3	3		5/16	6/5,6/22					
Artemisia tridentata subsp. wyomingensis	3	3			5/16,6/5	6/22				
Physaria acutifolia	2	3			5/16,6/5		6/22		7/20(90%)	7/20(10%)
Linum lewisii	2	3			5/16	6/5(65%)	6/5(35%)6/22		7/20	
Cryptantha sericea	2	3					6/5,6/22			7/20
Rhus trilobata	3	2				6/5,6/22(90%)			6/22(10%), 7/20	
Holodiscus dumosus	3	2						7/20		
Prunus virginiana	3	1				5/16	6/5	6/22		
Rosa sp.	2	2			5/16,6/5, 7/20					
Symphoricarpos oreophilus	2	2			5/16	6/5		6/22, 7/20		
Oryzopsis hymenoides	2	2		5/16	6/22(90%)	6/22(10%)				
Senecio canus	2	2			5/16		6/5,6/22			7/20
Mertensia lanceolata	2	2					5/16,6/5	6/22		
Gilia candida	2	2				6/5	6/22			7/20
Purshia tridentata	3	1		5/16				7/20		
Cercocarpus montanus	3	1		5/16,6/5 (25%)	6/5(75%), 7/20					
Ribes cereum	3	1							6/22,7/20	
Tetradymia canescens	3	1					7/20			
Streptanthus cordatus	2	1			5/16	5/16,6/5		7/20		
Lupinus greenii	2	1	5/16	6/5	6/22					
Heuchera parvifolia	2	1				5/16		6/5,6/22		
Chaenactis douglasii	2	1					6/22			
Euphorbia robusta	2	1				6/22				7/20
Penstemon watsonii	2	1				6/5	6/22			7/20

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

AMELANCHIER ALNIFOLIA/CAREX HABITAT TYPE.

This is a topographic climax restricted to snow drift accumulation sites on north and east facing slopes. Amelanchier alnifolia dominates the overstory averaging about 78 inches in height (Figure 9). The associated understory is usually dominated by Carex and members of the Festuca idahoensis union described for the Artemisia tridentata, vaseyana/Festuca idahoensis habitat type. Some of the most common species include Symphoricarpos oreophilus, Lupinus spp., Galium boreale and Chrysothamnus viscidiflorus.

This habitat type occurs at elevations that range from 7400 to 8500 feet. Slopes range from 25 to 70% with north and east facing exposures. Nearly all the ground surface is covered with vegetative growth.

The soils that occur within this type are all dark mollisols. The dominant soil is represented by Clayburn loam, a member of the fine-loamy, mixed family of Argic Pacic Cryoborolls. A few areas have much more gravel in the soil profile including the Handren series. The parent material is colluvium and local windblown fine soil material. Geologic formations include Pierre Shale, terrace deposits, Boulder Creek Granodiorite and biotite gneiss. This habitat type is slightly dryer and warmer than the aspen forest habitat types.

The Amelanchier alnifolia/Agropyron spicatum habitat type occurs on rocky soils, has more bare ground, and does not occur in snow drift positions as is true of the Amelanchier alnifolia/Carex habitat type.

Species that occur in the Amelanchier alnifolia/Carex but not in the Amelanchier alnifolia/Agropyron spicatum habitat type include Carex, Festuca idahoensis, Galium boreale, Lupinus spp. and Heuchera parvifolia.

Table 25. Cover and frequency data for Amelanchier alnifolia/Carex stands. Data for each stand are in three columns: mean percent cover, (standard error of the mean), and percent frequency.

Stand Number	47			48			49			52			53			55		
GRASSES AND GRASSLIKES																		
Agropyron spicatum	1.00	(.67)	17	2.96	(1.15)	27	4.53	(1.37)	40	.53	(.35)	10	2.73	(1.43)	17			
Agropyron spp.													4.70	(1.30)	43	1.20	(.74)	13
Agrostis scabra							.86	(.47)	13									
Bromus anomalus	.43	(.33)	10	1.90	(1.36)	17	.26	(.18)	7				.13	(.09)	7			
Carex	65.66	(3.94)	100	40.13	(5.60)	80	4.20	(1.69)	27	61.40	(5.83)	93	22.80	(2.92)	90	47.00	(5.27)	97
Festuca idahoensis				.33	(.33)	3				11.96	(2.54)	67	.10	(.10)	3	8.70	(1.99)	57
Koeleria cristata	.40	(.33)	7				2.13	(1.11)	17				4.33	(1.38)	37	.06	(.06)	3
Oryzopsis hymenoides	.33	(.33)	3															
Poa fendleriana				.60	(.37)	10	6.46	(1.46)	50	.20	(.11)	10	5.60	(1.88)	33	1.00	(.73)	7
Poa nevadensis				1.00	(1.00)	3												
Poa pratensis	1.46	(.63)	17				.53	(.35)	10	.13	(.13)	3						
Stipa comata				.20	(.14)	7												
Stipa pinetorum													.13	(.13)	3			
Sitanion hystrix	.80	(.47)	10	.06	(.06)	3	.06	(.06)	3	.10	(.10)	3	.33	(.33)	3			
OTHER GRASSES													1.00	(.73)	7			
FORBS																		
Achillea lanulosa	.13	(.13)	3				.06	(.06)	3	.10	(.10)	3				.40	(.15)	20
Antennaria anaphaloides	.06	(.06)	3													.63	(.36)	13
Antennaria parvifolia	.03	(.03)	3							1.20	(.73)	17	1.66	(1.08)	10			
Arnica cordifolia																.06	(.06)	3
Astragalus convallarius							.73	(.66)	7							.30	(.17)	10
Balsamorhiza sagittata	3.46	(.99)	33													4.60	(1.90)	43
Castilleja flava	.06	(.06)	3															
Circium spp.	.53	(.35)	10															
Clematis hirsutissina	.06	(.06)	3										3.40	(1.20)	27	.63	(.36)	17
Clematis pseudoalpina													3.56	(1.34)	37			
Commandra umbellata										.10	(.07)	7						
Delphinum nelsonii							1.43	(.62)	20									
Erigeron eatonii	.20	(.14)	7				.03	(.03)	3	.13	(.13)	3				.40	(.33)	7
Erigeron engelmanii							.33	(.33)	3	.06	(.06)	3						

Table 25. Continued.

Erigeron speciosus	1.60	(.79)	17	.13	(.13)	3	.06	(.06)	3							4.66	(1.49)	30
Eriogonum umbellatum	3.00	(1.15)	33	2.63	(1.23)	23				14.73	(3.56)	63	1.70	(.92)	23	.70	(.38)	40
Galium boreale	.46	(.22)	17	.06	(.06)	3	7.06	(1.33)	63				.96	(.37)	33	.36	(.33)	7
Geum triflorum												.06		(.06)	3			
Heuchera parvifolia	.63	(.36)	17				1.73	(.68)	20	1.43	(.50)	30	.13	(.07)	10	.63	(.24)	23
Lupinus ammophilus	2.16	(.57)	47															
Lupinus greenii							5.86	(2.11)	30	4.10	(2.34)	30	.80	(.47)	10	2.90	(.71)	50
Mertensia lanceolata	.10	(.07)	7	.10	(.10)	3	.13	(.09)	7				.50	(.17)	30	.06	(.06)	3
Penstemon caespitosus							.13	(.13)	3									
Penstemon watsoni				.20	(.12)	10				.06	(.06)	3	.73	(.66)	7			
Phlox multiflora							.50	(.21)	17	1.60	(.63)	23				2.53	(1.10)	27
Potentilla concinna	.13	(.09)	7													.23	(.14)	10
Taraxacum officinale	.06	(.04)	7													.03	(.03)	3
Wyethia arizonica							.66	(.66)	3									
LICHEN													.23	(.11)	13			
MOSS	.33	(.33)	3				4.86	(2.04)	30				2.46	(1.41)	13	2.63	(1.13)	27
MUSTARD										.03	(.03)	3						
OTHER FORBS							.06	(.06)	3							.53	(.35)	10
SHRUBS																		
Amelanchier alnifolia	41.53	(5.91)	83	43.46	(6.78)	77	67.26	(5.44)	97	18.66	(4.64)	47	45.83	(5.89)	90	47.73	(6.33)	90
Artemisia tridentata subsp. vaseyana	1.00	(1.00)	3	6.06	(2.71)	30	.73	(.66)	7	3.13	(1.52)	17	2.43	(1.40)	17	1.53	(1.04)	13
Berberis repens	.13	(.13)	3													.03	(.03)	3
Cercocarpus montanus				.33	(.33)	3				4.36	(1.95)	23				.40	(.33)	7
Chrysothamnus viscidiflorus var. viscidiflorus	2.26	(1.11)	17	.83	(.66)	13	1.26	(1.00)	10	1.80	(1.18)	10	.33	(.33)	3	.33	(.33)	3
Juniperus communis	.66	(.66)	3															
Pachystima myrsinites	.80	(.39)	17							1.80	(.84)	17						
Prunus virginiana				.86	(.67)	10	.33	(.33)	3									
Purshia tridentata	.33	(.33)	3	3.00	(1.92)	10				2.33	(2.33)	3						
Ribes cereum							.66	(.66)	3									
Rosa sp.				.33	(.33)	3							3.06	(1.05)	30			
Symphoricarpos oreophilus	21.33	(3.13)	80	12.46	(2.53)	80	24.26	(3.89)	83	17.33	(3.91)	60	15.63	(2.35)	90	14.53	(2.89)	80
BARE GROUND	.40	(.33)	7	3.96	(1.68)	23	.26	(.18)	7	1.00	(.67)	17	3.13	(1.04)	40	.50	(.22)	17
LITTER	10.20	(1.60)	97	13.70	(2.18)	87	26.20	(4.14)	93	6.20	(1.46)	70	16.96	(2.56)	100	13.03	(2.16)	93
Total % Cover	151.23	(7.34)		117.70	(7.99)		137.30	(5.07)		147.33	(6.30)		125.40	(5.36)		144.87	(7.18)	
Species Diversity		34			23			31			26			29			31	

Table 26. Abiotic characteristics of the Amelanchier alnifolia/Carex habitat type.

STAND NO.	47	48	49	52	53	55
Date of Sample	7/28/77	7/28/77	7/29/77	8/11/77	9/12/77	8/16/77
LOCATION:						
Quarter	NE,NW	NE,SW	SE,SE	SW,NW	SE,SW	NE,SW
Section	27	22	15	23	15	1
Township	1W	1N	1N	1N	1N	2S
Range	80W	80W	80W	79W	80W	80W
TOPOGRAPHY:						
Slope %	65	35	50	50	70	45
Aspect °Az.	25	85	350	20	350	25
Position	Mid 1/3	Upper 1/3	Mid 1/3	Upper 1/3	Mid 1/3	Mid 1/3
Elevation, ft	8320	8480	7440	8320	7520	8350
LAND FORM	Slope	Slope	Slope	Slope Uplands	Slope Uplands	Slope Uplands
Soil Temperature °C	11°	11.5°	13°	11°	13°	13°
Surface Cobbles & Stones %		3		1	1	
DISTURBANCE:						
Grazing	Slight	Slight	Slight	Slight	Slight	Slight
Erosion	Slight	Slight	Slight	Slight	Slight	Slight
SSF	9	25	27	17	22	20
Successional Stage	Stable	Stable	Late Seral	Stable	Stable	Climax
Height of Dominant Layer (inches)	96	84	60	84	60	84

Table 27. Phenological data for important species in the Amelanchier alnifolia/Carex habitat type.

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Symphoricarpos oreophilus	4	4		5/16[1]	6/6,7/29 (90%)[2]		6/22,7/29 (10%)			
Amelanchier alnifolia	4	4			5/16(90%)	5/16(10%)	6/6		6/22,7/29	
Koeleria cristata	2	3	5/16			6/6	6/22,7/29 (35%)	7/29(35%)	7/29(30%)	
Delphinum occidentale	2	3						7/29		
Lupinus greenii	2	3	5/16	6/6	6/22(65%)	6/22(35%)	7/29(35%)	7/29(35%)	7/29(30%)	
Galium boreale	2	3		5/16	6/6,6/22 (25%)		6/22(75%)	7/29		
Astragalus convallarius	2	3			6/6			6/22		5/16
Chrysothamnus viscidiflorus	3	2		5/16	6/6,7/29 (65%)		7/29(35%)			
Agropyron spicatum	3	2	5/16	6/6		6/27,7/29 (90%)	7/29(10%)			
Poe fendleriana	2	2	5/16			6/6	6/22(50%)	6/22(50%)	7/29	
Bromus sp.	2	2			7/29					
Erigeron eatonii	2	2			5/16		6/6			
Aquilegia caerulea	2	2						5/16,6/6	6/22	
Juniperus scopulorum	3	1			7.29					
Artemisia tridentata subsp. vaseyana	3	1				6/22,7/29				
Prunus virginiana	3	1						6/22		
Ribes cereum	3	1			6/22			7/29		
Juniperus communis	2	1						6/22		
Poa sp.	2	1				6/22,7/29 (50%)	7/29(50%)			
Mertensia lanceolata	2	1					5/16	6/22	7/29	
Heuchera parvifolia	2	1		6/6	6/22(50%)	6/22(50%)		7/29		
Eriogonum umbellatum	2	1					6/22			
Penstemon caespitosus	2	1			6/22					
Phlox multiflora	1	1					6/6	6/22,7/29		
Antennaria parvifolia	1	1		5/16				6/22	7/29	
Phlox bryoides	1	1					5/16	6/22	7/29	
Gilia candida	1	1					6/22			

[1] Refers to the date of observation.

[2] The number in parentheses refers to the percent of the particular species that is at this phenological stage.

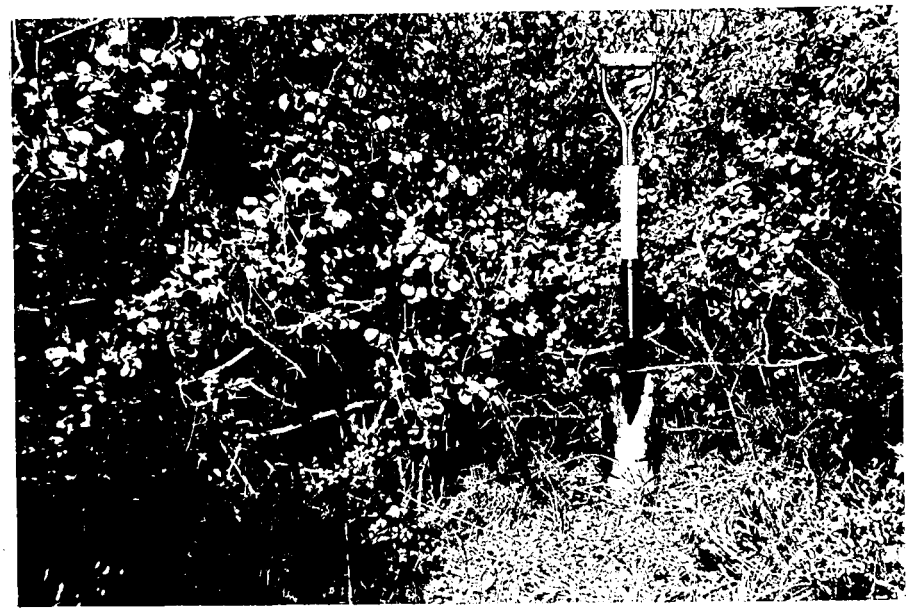

Figure 9. Amelanchier alnifolia/Carex habitat type.

Figure 10. Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type.

CHRYSOTHAMNUS PARRYI-ORYZOPSIS HYMENOIDES/ERIOGONUM BREVICAULE HABITAT TYPE

This habitat type is characterized by severely eroded slopes usually with more than 70% of the soil surface devoid of vegetation (badlands) (Figure 10). Because of its eroded appearance this type is often referred to as unstable. This is a topo-edaphic climax depend-end upon steep slopes and erosive soil. Annual overflow and soil movement maintains the shared dominance of Chrysothamnus parryi and Oryzopsis hymenoides rather than Oryzopsis hymenoides alone as in the more stabilized Oryzopsis hymenoides/Eriogonum brevicaule habitat type. Other important species include Eriogonum brevicaule, Chaenactis douglasii, Oenothera caespitosa, Artemisia tridentata, Berberis repens and Amelanchier alnifolia.

Elevations range from 7300 to 8700 feet. Slopes usually range from 30 to 70% for most aspects, with south and west-facing slopes more common. The geologic material is primarily of Pierre Shale. The most common soils include Binco, Roxal, Harsha, and Yovimpa series. The Yovimpa series is most representative of this habitat type. Yovimpa is a member of the clayey, mixed shallow family of typic Cryorthents.

Table 28. Layer and dominance rating (the latter in parentheses) for species in the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type.

STANDS	45	43	50	52	59	60	190	129
FORBS								
Phlox multiflora		1(3)						
Astragalus convallarius					2(3)		2(1)	
Chaenactis douglasii	2(3)	2(3)			2(1)	2(3)	2(1)	2(1)
Mertensia lanceolata	2(3)	2(3)			2(3)		2(3)	
Lupinus greenii		2(2)				2(3)		
Eriogonum brevicaule	2(3)		2(4)	2(3)			2(1)	2(3)
Senecio multilobatus	2(3)						2(3)	
Linum lewisii	2(1)							
Commandra umbellata					2(3)			
Balsamorhiza sagittata		2(3)			2(3)	2(3)	2(3)	
Castilleja flava		2(3)				2(2)	2(1)	
Galium boreale		2(1)						
Potentilla concinna		2(3)						
Sphaeralcea coccinea		2(3)						
Gilia calcarea				2(3)	2(3)	2(3)		2(3)
Cryptantha sericea		2(3)	2(3)	2(3)	2(3)		2(3)	
Cryptantha sp.		2(3)						
Crepis acuminata						2(1)	2(1)	
Crepis sp.								2(2)
Artemisia ludoviciana			2(3)		2(3)			2(3)
Mertensia ciliata	2(3)				2(3)			
Streptanthus cordatus						2(2)		
Aster sp.		2(3)						
Oenothera caespitosa		2(3)	2(3)	2(3)	2(3)		2(1)	2(3)
Physaria sp.	2(3)				2(3)		2(2)	2(2)
Berberis repens	2(3)	2(3)			2(3)	2(2)		
Astragalus flexuosus	2(3)							
Vicia americana	2(3)	2(1)						
Taraxacum officinale							2(2)	
Capsella bursa-pastoris	2(3)							
Mentzilia sp.							2(1)	
Erigeron engelmanii							2(1)	
# Other species			2					
Dominance of others			2(3)				2(3)	

Table 28. Continued

STANDS	45	43	50	52	59	60	190	129
GRASSES & GRASSLIKES								
Agropyron spicatum	3(3)	2(3)		2(1)	2(5)	2(3)	2(3)	
Agropyron smithii	2(3)	2(3)			2(2)			
Sitanion hystrix	2(1)						2(1)	
Koeleria cristata		2(3)						
Oryzopsis hymenoides	2(5)	2(3)	2(3)	2(3)	2(3)	2(3)	2(4)	2(5)
Carex spp.	2(3)							
SHRUBS								
Artemisia tridentata subsp. wyomingensis		3(3)			3(1)	3(3)	2(3)	3(1)
Chrysothamnus viscidiflorus	2(3)	2(3)					2(1)	
Chrysothamnus nauseosus var. glabratus								
Juniperus scopulorum		4(1)				4(3)	4(1)	
Symphoricarpos oreophilus	3(3)	3(3)					3(2)	
Amelanchier alnifolia		3(3)			3(3)	4(3)	3(1)	2(2)
Artemisia frigida					2(3)			
Purshia tridentata	3(3)	3(3)		3(1)			3(2)	3(2)
Tetradymia canescens		3(3)					3(2)	
Ribes cereum							3(1)	
Chrysothamnus parryi var. attenuatus	3(5)	3(4)	3(4)	3(3)	3(5)	3(4)	3(4)	3(5)
Prunus virginiana	3(3)			3(3)				2(3)
Rosa acicularia						3(2)		
Cercocarpus montanus				3(2)		3(2)		

Table 29. Phenological data for important species in the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type (Stand 190).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Chrysothamnus parryi var. attenuatus	3	4			5/15[1],6/20, 7/21(65%)[2]	7/21(35%)				
Oryzopsis hymenoides	3	4		5/15	6/9		6/20		7/21	
Artemisia tridentata subsp. wyomingensis	3	3		5/5,6/8	6/20,7/21					
Symphoricarpos oreophilus	3	3			5/15,6/9,6/20					
Agropyron spicatum	3	3		5/15	6/9	6/20		7/21		
Mertensia lanceolata	3	3				5/15	6/9(50%)	6/9(50%), 6/20		7/21
Balsamorhiza sagittata	3	3			5/15(50%)		5/15(50%)	6/9,6/20	7/21	
Senecio multilobatus	3	3					5/15,6/9, 6/20(50%)	6/20(50%)		
Purshia tridentata	3	2		5/15			6/8,6/20(50%)	6/20(50%)	7/21	
Tetradymia canescens	3	2			5/15,6/9,6/20		7/21			
Taraxacum officinale	3	2			5/15,6/20					
Cryptantha sericea	2	2					6/9,6/20			
Juniperus scopulorum	4	1			5/15,6/20(50%)				6/20(50%)	
Amelanchier alnifolia	3	1				5/15	6/9(50%)	6/9(50%), 6/20(50%)	6/20(50%)	
Castilleja flava	3	1		5/15						
Ribes cereum	3	1						7/21		
Chrysothamnus viscidiflorus	2	1			6/9,6/20					
Sitanion hystrix	2	1				6/9	6/20			
Chaenactis douglasii	2	1					6/20	7/21(50%)		7/21(50%)
Oenothera caespitosa	2	1					6/9,6/20		7/21	
Mentzelia sp.	2	1					6/9,6/20	7/21		
Crepis acuminata	2	1					6/20			
Astragalus convallarius	2	1			6/9					
Eriogonum brevicaule	2	1					6/20(50%)	6/20(50%)		
Erigeron eugelmanii	2	1					7/21			

[1] Refers to the date of observation.

[2] The number in parentheses refers to the percent of the particular species that is at this phenological stage.

ORYZOPSIS HYMENOIDES/ERIOGONUM BREVICAULE HABITAT TYPE.

This habitat type is characterized by a sparse vegetative cover on light colored, clayey soil with a dominance of Oryzopsis hymenoides and associated species including Eriogonum brevicaule, Haplopappus armeriodes, Eurotia lanata and Agropyron species (Figure 11).

Much of the area is bare ground occupying more than 75% of the area. The soil surface usually has a powdery grayish white appearance that is occasionally capped with a thin gravel layer. Soils are very erosive. This habitat type is commonly referred to as stabilized badlands. The Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type is a topographic climax similar to this type, but considered as unstable badlands naturally subject to severe gully erosion.

Elevations range from 7300 to 7600 feet. This habitat type occupies rolling terrain commonly on ridgetop positions exposed to wind, desiccation and erosion but not exposed to the excessive runoff that causes the sharply incised gullies and barren areas characteristic of the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type.

The soils are developed from Pierre Shale or Troublesome Mudstone. Binco, Roxal, Harsha and Yovimpa soil series occur within this habitat type. However, Roxal is most representative of this habitat type. Roxal is a member of the loamy mixed (Calcareous) shallow family of Typic Cryorthents.

This habitat type is not very extensive in Middle Park and was not sampled as completely as other habitat types of the mule deer critical winter range.

Table 30. Layer and dominance rating (the latter in parentheses) for species in the Oryzopsis hymenoides/Eriogonum brevicaule habitat type.

STANDS	129	150	158	121	119	73
FORBS						
Phlox bryoides		1(4)		1(3)	1(3)	1(1)
Phlox multiflora		1(4)		1(1)	1(3)	1(2)
Penstemon caespitosus		1(4)		1(1)	1(3)	1(2)
Astragalus convallarius		2(1)				
Astragalus drummondii						2(3)
Hymenopappus filifolius		2(2)	2(4)		2(3)	2(3)
Chaenactis douglasii	2(1)					
Mertensia lanceolata		2(1)				
Eriogonum brevicaule	2(3)	2(3)	2(4)	2(2)	2(3)	2(3)
Haplopappus nuttallii		2(3)		2(3)	2(4)	2(4)
Mamillaria vivipara				1(1)		
Opuntia polyacantha		2(1)				
Senecio canus		2(2)				2(1)
Erigeron engelmanii			2(3)			
Commandra umbellata			2(3)			
Lichen				1(2)		1(2)
Haplopappus armeriodes		2(1)	2(3)	2(1)	2(3)	2(4)
Oxytropis sericea						2(3)
Sphaeralcea coccinea		2(3)	2(1)			
Gilia calcarea	2(3)					2(1)

Table 30. Continued

STANDS	129	150	158	121	119	73
Cryptantha sericea						2(1)
Crepis sp.	2(2)					
Artemisia ludoviciana	2(3)					
Mertensia ciliata		2(1)				
Oenothera caespitosa	2(3)					
Physaria sp.	2(2)					
GRASSES & GRASSLIKES						
Agropyron spicatum		2(5)	2(4)		2(3)	2(2)
Agropyron smithii		2(3)	2(1)	2(3)		2(4)
Stipa comata		2(3)		2(4)		
Bouteloua gracilis				2(2)		
Oryzopsis hymenoides	2(5)	2(2)		2(4)	2(3)	2(2)
Poa secunda				2(3)		
Carex spp.						2(1)
SHRUBS						
Artemisia tridentata subsp. wyomingensis	2(1)	2(1)		2(1)	2(1)	
Chrysothamnus viscidiflorus				2(2)	2(4)	

Table 30. Continued

STANDS	129	150	158	121	119	73
Amelanchier alnifolia	2(2)	2(1)				
Artemisia frigida		2(3)		2(3)		2(2)
Purshia tridentata	3(2)					
Tetradymia canescens		2(2)	2(1)	2(2)	2(3)	3(2)
Eurotia lanata		2(2)	2(3)	2(3)		2(2)
Chrysothamnus parryi var. attenuatus	3(5)	3(1)				3(3)
Prunus virginiana	2(3)					
Gutierrezia sarothrae		2(3)			2(3)	2(3)

Table 31. Phenological data for important species in the Oryzopsis hymenoides/Eriogonum brevicaule habitat type (Stand 73).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Haplopappus armeroides	2	4				5/14[1]	6/8	6/21		
Haplopappus nuttallii	2	4	5/14			6/8,6/21				
Hymenopappus filifolius	2	3		5/14	6/8(80%)[2]	6/8(20%)	6/21			
Chrysothamnus parryi var. attenuatus	3	3		5/14	6/8,6/21					
Gutierrezia sarothrae	2	3			6/8,6/21					
Astragalus drummondii	2	3		5/14	6/8,6/21					
Eriogonum brevicaule	2	3	6/8				6/21			
Tetradymia canescens	3	2		5/14	6/8,6/21					
Artemisia frigida	2	2			5/14,6/8	6/21				
Oryzopsis hymenoides	2	2		5/14	6/8,6/21					
Agropyron spicatum	2	2	5/14	6/8		6/21				
Gilia calcarea	2	2			6/8		6/21			
Senecio canus	2	1			6/8		6/21			
Physaria acutifolia	2	1					6/8.6/21			
Cryptantha sericea	2	1					6/21			
Carex sp.	2	1				6/21				
Phlox bryoides	1	1			5/14(50%)		5/14(50%)	6/21		

[1] Refers to the date of observation.

[2] The number in parentheses refers to the percent of the particular species that is at this phenological stage.

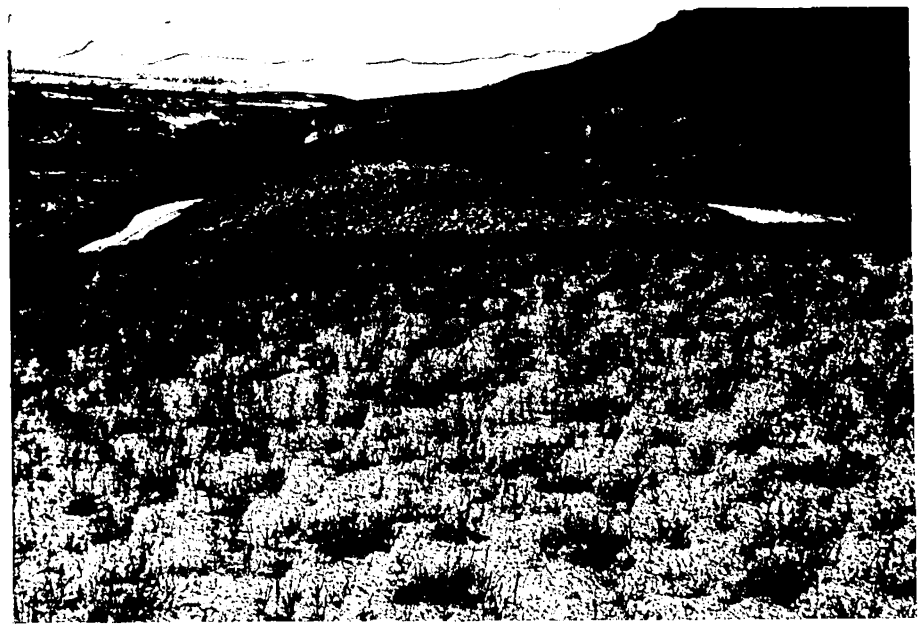

Figure 11. Oryzopsis hymenoides/Eriogonum brevicaule habitat type.

Figure 12. Artemisia longiloba/Poa secunda habitat type.

HABITAT TYPES OUTSIDE THE MULE DEER CRITICAL WINTER RANGE

ARTEMISIA LONGILOBA/POA SECUNDA HABITAT TYPE.

This habitat type is characterized by the overstory dominance of the low growing Artemisia longiloba averaging 6 inches in height. This is an edaphic climax specific to heavy clay soils that have a restrictive clay layer at about 10 inches in depth. Poa secunda is considered as the climax understory dominant although under present management Sitanion hystrix and Poa fendleriana, both members of the climax association, share dominance in the understory with Poa secunda (Figure 12).

Elevations range from 7800 to 8600 feet. Slopes range from 0 to more than 35% at most aspects. This habitat type occupies rolling uplands and alluvial fans of the Troublesome Formation and local clayey alluvium. Most soils would be classified as Argic Cryoborolls.

Table 32. Layer and dominance rating (the latter in parentheses) for species in the Artemisia longiloba/Poa secunda habitat type.

STAND	104	86	162	182
FORBS				
Phlox bryoides	1(3)	1(3)		1(3)
Phlox multiflora		1(3)	1(4)	
Penstemon caespitosus		1(4)		1(3)
Eriogonum umbellatum		2(2)	2(2)	
Lichen				1(3)
Senecio multilobatus				2(2)
Erigeron eatonii			2(2)	
Sedum stenopetalum				1(3)
GRASSES & GRASSLIKES				
Agropyron spicatum		2(2)	2(1)	
Agropyron smithii	2(3)		2(4)	2(1)
Stipa pinetorum	2(3)	2(2)		2(2)
Stipa comata	2(3)	2(2)		
Sitanion hystrix	2(3)	2(3)	2(2)	2(2)
Koeleria cristata				2(3)
Bromus tectorum			2(1)	
Poa fendleriana	2(2)	2(3)		2(3)
Poa secunda	2(4)	2(1)	2(3)	2(3)
Elymus cinereus			2(3)	
Festuca idahoensis		2(3)		
SHRUBS				
Chrysothamnus viscidiflorus	2(3)	2(1)		
Symphoricarpos oreophilus	2(1)	2(1)		
Artemisia frigida	2(1)			
Eurotia lanata	2(2)			
Gutierrezia sarothrae		2(1)	2(2)	2(3)
Artemisia longiloba	2(5)	2(5)	2(5)	2(5)
Chrysothamnus vaseyi		2(2)	2(3)	

Table 33. Phenological data for important species in the Artemisia longiloba/Poa secunda habitat type (Stand 182).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia longiloba	2	5			5/15[1]	6/6,6/21				
Chrysothamnus viscidiflorus	2	3		5/15	6/6,6/21					
Poe fendleriana	2	3				5/15,6/6	6/21			
Poa secunda	2	3				5/15	6/6			
Koeleria cristata	2	3				6/6	6/21			
Phlox bryoides	1	3					5/15	6/6,6/21		
Penstemon caespitosus	1	3		5/15	6/6(80%)[2]		6/6(20%)	6/21		
Lichen	1	3			5/15,6/21					
Sedum stenopetalum	1	3			5/15(50%)	5/15(50%),6/6	6/21(33%)	6/21(67%)		
Sitanion hystrix	2	2				6/6,6/21(50%)	6/21(50%)			
Senecio multilobatus	2	2			5/15			6/6		
Agropyron smithii	2	1	5/15	6/6		6/21				
Mamillaria vivipara	1	1						6/21		

[1]Refers to the date of observation

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

ARTEMISIA TRIDENTATA WYOMINGENSIS/STIPA COLUMBIANA HABITAT TYPE.

This habitat type is a climatic climax characterized by an overstory of Artemisia tridentata wyomingensis with an average height of 13 inches (Figure 13). The associated understory includes Stipa columbiana, Koeleria cristata, Sitanion hystrix, Agropyron smithii and Poa fendleriana. As much as 30% of the soil surface is bare with the characteristic of a cracked surface forming small polygons. Few forbs are present consisting mostly of the low growing Phlox bryoides, Penstemon caespitosus and Eriogonum umbellatum.

Elevations range from 7600 to 8000 feet. Slopes range from 0 to 20 percent at all aspects. This habitat type occupies plateau tops usually of Pierre Shale geological material of the Cretaceous Period.

Soils usually are loamy on the surface with an argillic layer of clay accumulation at about 15 inches. The Harsha series, a member of the fine loamy mixed family of Borollic Haplargids is most representative of the habitat type.

The Artemisia tridentata wyomingensis/Agropyron smithii habitat is very similar but generally occurs at lower elevations on plateau tops of the Troublesome Formation or terrace deposits rather than Pierre Shale. Soils are very similar but slightly lighter in color.

Table 34. Layer and dominance rating (the latter in parentheses) for species in the Artemisia tridentata wyomingensis/ Stipa columbiana habitat type.

STAND	92	87	83	82	84
FORBS I					
Phlox bryoides		1(3)	1(3)	1(3)	
Phlox multiflora	1(3)				
Penstemon caespitosus		1(3)	1(3)	1(3)	1(2)
Penstemon strictus				1(1)	
Eriogonum umbellatum	2(3)	2(3)	2(3)	2(3)	
Antennaria parvifolia	1(3)				
Lupinus ammophilus	2(3)				
Mamillaria vivipara			1(2)	1(1)	
Opuntia polyacantha		2(2)			
Senecio multilobatus			2(1)		
Erigeron eatonii	2(2)				
Castilleja flava	2(3)				
Lichen	1(3)		1(3)	1(3)	
Berberis repens	2(1)				
Achillea lanulosa	2(1)				
GRASSES AND GRASSLIKES					
Agropyron spicatum		2(2)			
Agropyron smithii	2(1)		2(4)	2(3)	2(3)
Stipa pinetorum	2(3)		2(3)		
Stipa comata		2(3)	2(2)		
Sitanion hystrix	2(2)	2(3)	2(3)	2(2)	2(3)
Koeleria cristata	2(3)	2(3)	2(1)	1(1)	2(3)
Bouteloua gracilis			2(3)	2(3)	2(1)
Oryzopsis hymenoides		2(1)			
Poa fendleriana			2(2)	2(2)	2(3)
Poa secunda	2(3)				
Carex spp.	2(3)	2(3)	2(2)	1(3)	
Poa nevadensis	2(4)				
Stipa columbiana		2(3)	2(3)	2(4)	2(3)
SHRUBS					
Artemisia tridentata subsp. wyomingensis	3(5)	3(5)	3(5)	3(5)	3(5)
Chrysothamnus viscidiflorus	2(3)	2(4)	2(3)	2(4)	
Chrysothamnus nauseosus var. glabratus	2(1)	2(1)			3(4)
Symphoricarpos oreophilus		2(2)			
Tetradymia canescens	2(1)				
Eurotia lanata			2(3)	2(2)	
Gutierrezia sarothrae			2(1)		

Table 35. Phenological data for important species in the Artemisia tridentata wyomingensis/Stipa columbiana habitat type (Stand 83).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia tridentata subsp. wyomingensis	3	5			5/17[1] 6/8,6/21					
Agropyron smithii	2	4	5/17	6/8	6/21(90%)[2]	6/21(10%)				
Phlox bryoides	1	3			5/17		6/8	6/21		
Lichen	1	3			6/21					
Penstemon caespitosus	1	3	5/17	6/8				6/21		
Eurotia lanata	2	3	5/17	6/8	6/21					
Chrysothamnus viscidiflorus	2	3	5/17	6/8,6/21 (50%)	6/21(50%)					
Bouteloua gracilis	2	3	5/17	6/8	6/21					
Stipa pinetorum	2	3	5/17	6/8(90%)	6/21	6/8(10%)				
Stipa columbiana	2	3	5/17,6/8	6/21						
Poe fendleriana	2	3	5/17				6/8,6/21			5/17
Eriogonum umbellatum	2	3	5/17		6/8,6/21					
Carex sp.	2	2	5/17	6/8	6/21					
Mamillaria vivipara	1	2			6/8,6/21					
Koeleria cristata	2	1	5/17	6/8						
Senecio multilobatus	2	1								5/17

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Figure 13. Artemisia tridentata wyomingensis/Stipa columbiana habitat type.

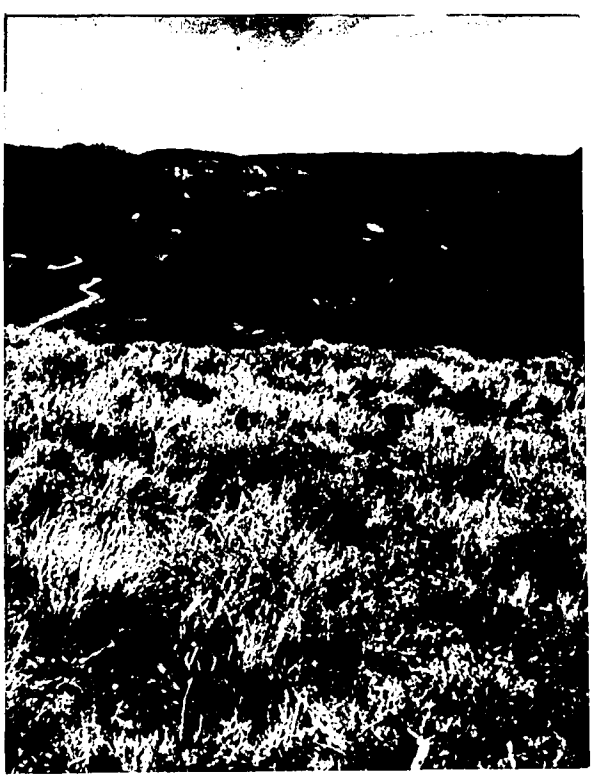

Figure 14. Purshia tridentata-Artemisia tridentata vaseyana/Festuca idahoensis habitat type.

PURSHIA TRIDENTATA-ARTEMISIA TRIDENTATA VASEYANA/FESTUCA IDAHOENSIS HABITAT TYPE.

This habitat is characterized by the shared dominance of Purshia tridentata and Artemisia tridentata vaseyana averaging 18 inches in height. This is an edaphic climax specific to sandy soil developed from decomposing basalt, sandstone or granite. Very little bare ground is exposed except for occasional cobbles or stones that may occupy up to 15% of the area (Figure 14).

Carex species are usually conspicuously present but the stands studied were usually dominated by Poa fendleriana or Agropyron spicatum. Festuca idahoensis is considered as the important climax understory species although it was not represented in all stands studied. Carex species and Balsamorhiza sagittata are the best understory indicator species for this habitat type under present use. Other important but not dominant species include Symphoricarpos oreophilus and Amelanchier alnifolia.

Elevations range from 8000 to 8900 feet. This habitat type occupies rolling uplands and mountain slopes especially the Rabbit Ears Volcanics of the Miocene and Oligocene Period.

Table 36. Layer and dominance rating (the latter in parentheses) for species in the Purshia tridentata - Artemisia tridentata vaseyana/Festuca idahoensis habitat type.

STANDS	168	107	106	105	113	85	77	96	201
FORBS									
Phlox bryoides		1(2)				1(3)			2(2)
Phlox multiflora		1(3)			1(3)	1(3)	1(3)		
Penstemon caespitosus						1(3)	1(1)		
Penstemon watsoni		2(2)					2(2)		
Penstemon strictus				2(2)			2(2)		
Eriogonum umbellatum		2(3)	2(3)	2(3)	2(3)	2(1)	2(3)	2(3)	2(2)
Antennaria parvifolia							1(2)		
Chrysopsis villosa	2(2)								
Astragalus sp.									2(3)
Astragalus convallarius		2(2)		2(1)	2(2)	2(3)		2(1)	2(1)
Chaenactis douglasii					2(3)				
Mertensia lanceolata		2(2)		2(3)	2(2)			2(3)	2(3)
Lupinus ammophilus			2(3)	2(2)			2(2)		2(3)
Mamillaria vivipara		1(1)							
Opuntia polyacantha	2(1)								
Senecio multilobatus	2(3)								2(1)
Gilia candida					2(1)				
Erigeron engelmanii									2(1)
Erigeron eatonii				2(2)	2(2)	2(2)			
Commandra umbellata			2(3)			2(2)	2(3)		2(3)
Balsamorhiza sagittata	2(2)	2(3)	2(3)	2(3)	2(3)	2(3)	2(4)	2(4)	2(3)
Mustard sp.	2(2)						2(2)		
Castilleja flava		2(2)	2(2)			2(3)	2(2)		2(2)
Potentilla hippiana							2(3)		
Potentilla concinna				2(2)					
Crepis acuminata						2(2)			
Delphinum nelsonii				2(1)					
Mertensia ciliata	2(2)				2(1)			2(2)	
Aster spp.					2(2)				
Berberis repens		2(1)			2(1)		2(1)		
Sedum stenopetalum							1(2)		
Lathyrus leucanthus							2(3)		

Table 36. Continued

STANDS	168	107	106	105	113	85	77	96	201
Clematis hirsutissina							1(1)		
Tryfolium gymnocarpon									2(2)
Taraxacum officinale		2(1)							
Calochortus gunnisoni							2(1)		
Lithospermum incisum		2(1)	2(2)	2(2)			2(1)		
Wyethia arizonica			2(3)						
Collinsia sp.	2(2)			2(2)					
Potentilla sp.	2(2)								
# Other species	1						1		
Dominance of others	2(1)						2(2)		
GRASSES & GRASSLIKES									
Agropyron spicatum	2(4)	2(4)			2(4)	2(5)		2(4)	2(2)
Agropyron smithii	2(2)	2(3)	2(2)	2(3)					
Stipa pinetorum							2(3)	2(3)	
Stipa comata	2(2)					2(1)	2(3)		
Sitanion hystrix	2(3)		2(2)			2(1)	2(3)	2(3)	
Koeleria cristata					2(2)	2(1)	2(3)	2(3)	2(3)
Oryzopsis hymenoides	2(4)				2(4)				
Poa fendleriana		2(4)	2(4)	2(4)					2(5)
Carex spp.	2(2)	2(3)	2(3)	2(4)		2(3)	2(3)	2(3)	2(3)
Poa pratensis							2(3)	2(2)	
Festuca idahoensis		2(3)	2(3)			3(4)	2(4)		
Stipa columbiana						2(3)		2(3)	
Poa spp.		2(1)				3(4)			

Table 36. Continued

STANDS	168	107	106	105	113	85	77	96	201
SHRUBS									
Artemisia tridentata subsp. wyomingensis	3(4)		3(5)		3(5)	3(4)		3(5)	
Chrysothamnus viscidiflorus	2(2)	2(3)	2(3)		3(4)	3(3)	2(3)	2(3)	2(3)
Chrysothamnus nauseosus var. glabratus				3(2)					
Juniperus scopulorum	4(5)								
Symphoricarpos oreophilus		2(3)	2(3)	3(3)	2(3)	3(3)	2(3)		3(2)
Amelanchier alnifolia		2(3)	3(2)	3(3)	2(1)		3(1)	3(2)	3(2)
Artemisia frigida	2(1)	2(3)							
Purshia tridentata	2(3)	3(4)	3(4)	3(3)	3(4)	3(4)	3(4)	3(3)	3(4)
Tetradymia canescens								3(1)	3(1)
Ribes cereum	2(3)								
Chrysothamnus parryi var. attenuatus	2(2)				3(2)				
Rosa acicularis				2(2)					
Artemisia tridentata var. vaseyana		3(5)	3(5)	3(5)			3(5)		3(4)

Table 37. Phenological data for important species in the Purshia tridentata-Artemisia tridentata vaseyana/Festuca idahoensis habitat type (Stand 201).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Poa fendleriana	2	5					5/16[1],6/21	6/21		
Purshia tridentata	3	4	5/16,6/6 (25%)		6/6(50%)		6/6(25%), 6/21(25%)	6/21(75%)		
Artemisia tridentata subsp. vaseyana	3	4			5/15,6/6	6/21				
Chrysothamnus viscidiflorus	2	3	5/16		6/6,6/21(75%)	6/21(25%)				
Koeleria cristata	2	3					6/21			
Hertensia lanceolata	2	3					5/16	6/6,6/21		
Lupinas ammophilus	2	3								5/16
Carex sp.	2	3	5/16(80%)				5/15(20%) 6/21(75%)	6/21(25%)		
Astragalus sp.	2	3				5/16				
Balsamorhiza sagittata	2	3		5/16			6/6(90%)	6/6(10%), 6/21		
Commandra umbellata	2	3				6/6		6/21		
Amelanchier alnifolia	3	2	5/16				6/6	6/21		
Symphoricarpos oreophilus	3	2	5/16		6/6,6/21					
Agropyron spicatum	2	2	5/16			6/21				
Castilleja flava	2	2		5/16		6/6,6/21				
Trifolium gymnocarpon	2	2			6/6			6/21		
Eriogonum umbellatum	2	2			6/6(90%), 6/21(70%)		6/6(10%), 6/21(30%)			
Phlox bryoides	2	2						6/21		
Tetradymia canescens	3	1			6/6					
Senecio multilobatus	2	1					6/6		6/21	
Astragalus convallarius	2	1					6/6			
Erigeron engelmanii	2	1					5/16			

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

AGROPYRON SPICATUM/POA FENDLERIANA HABITAT TYPE.

This habitat type is characterized by its high elevation position on bald wind swept ridge tops. Most shrubs are absent or in very low statured growth form. Agropyron spicatum and Poa fendleriana are dominants. Various forbs as Castilleja flava and Potentilla concinna suggest a more mesic environment than the lower elevation Agropyron spicatum/Artemisia frigida habitat type. Koleria cristata is usually present. The absence of Oryzopsis hymenoides, Eriogonum brevicaule, and Bouteloua gracilis differentiates this habitat type from the Agropyron spicatum/Artemisia frigida ridgetop habitat type.

Elevations range from 8000 to 10,000 feet. This habitat type occupies ridge tops of shallow gravelly dark brown soils. Soils are usually of the loamy-skeletal, mixed family of Lithic Cryoborolls represented by the Quander soil series (Figure 15).

not a Lithic Cryoboroll

Table 38. Layer and dominance rating (the latter in parentheses) for species in the Agropyron spicatum/Poa fendleriana habitat type.

STANDS	193	95	89
FORBS			
Phlox bryoides	1(4)	1(3)	
Penstemon watsoni		1(3)	
Penstemon strictus	2(2)		
Antennaria rosea	1(3)	1(3)	1(2)
Astragalus convallarius	2(1)	2(2)	
Mertensia lanceolata	2(3)		
Mamillaria vivipara	1(3)		
Senecio canus	2(1)		
Senecio multilobatus		2(2)	
Erigeron engelmanii	2(2)	2(2)	2(3)
Erigeron eatonii		2(2)	
Campanula rotundifolia			2(3)
Commandra umbellata	2(1)	2(3)	
Balsamorhiza sagittata		2(4)	
Castilleja flava	2(1)	2(3)	2(2)
Lichen	1(3)	1(2)	
Potentilla hippiana			2(3)
Potentilla concinna	2(3)	2(1)	2(4)
Eurphorbia robusta	2(1)		
Oxytropis sericea			2(3)
Delphinum nelsonii		2(3)	
Artemisia ludoviciana			2(2)
Physaria sp.	2(1)		
Sedum stenopetalum		1(2)	
Astragalus flexuosus	2(2)	2(3)	
Saxifraga sp.		2(2)	
Tryfolium gymnocarpon		1(1)	
Agoseris sp.	2(2)		
Lithospermum incisum			2(3)

Table 38. Continued

STANDS	193	95	89
GRASSES & GRASSLIKES			
Agropyron spicatum	2(4)		2(4)
Stipa pinetorum	2(2)		
Stipa comata	.		2(3)
Koeleria cristata	2(2)	2(3)	2(3)
Poa fendleriana	2(3)	2(1)	2(3)
Carex spp.	2(2)		2(3)
Festuca idahoensis		2(3)	
SHRUBS			
Artemisia tridentata subsp. wyomingensis		2(2)	2(2)
Chrysothamnus viscidiflorus		2(3)	2(2)
Chrysothamnus nauseosus	2(3)		
Juniperus scopulorum		3(1)	
Artemisia frigida	2(3)	2(3)	
Tetradymia canescens	2(1)	2(3)	2(3)

Table 39. Phenological data for important species in the Agropyron spicatum/Poa fendleriana habitat type (Stand 193).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Agropyron spicatum	2	4	5/16[1]	6/6		6/21				
Phlox bryoides	1	4								
Artemisia frigida	2	3			5/16	6/21				
Chrysothamnus viscidiflorus	2	3		5/16	6/6	6/21				
Poa fendleriana	2	3					5/16,6/6	6/21		
Mertensia lanceolata	2	3					5/16	6/6,6/21		
Trifolium gymnocarpon	2	3					5/16,6/6 (50%)[2]	6/6(50%)[2], 6/21		
Potentilla concinna	2	3					5/16,6/21	6/6(65%)	6/6(35%)	
Lichen	1	3		6/6						
Antennaria rosea	1	3				5/16(50%)	5/16(50%), 6/6,6/21(50%)	6/21(50%)		
Mamillaria vivipara	1	3					5/16	6/6,6/21		
Carex sp.	2	2					5/16,5/5,6/21			
Artemisia tridentata subsp. vaseyana	2	2			5/16	6/21				
Koeleria cristata	2	2					6/21			
Penstemon strictus	2	2			5/16		6/21			
Osmorhiza sp.	2	2					5/16			
Erigeron engelmanii	2	2					5/16,6/6,6/21			
Astragalus flexuosus	2	2					6/21			
Agoseris glauca	2	2					6/6			
Tetradymia canescens	2	1			6/6,6/21					
Euphorbia robusta	2	1			6/21					
Astragalus drummondii	2	1				6/6		6/21		
Senecio canus	2	1					6/6,6/21			
Physaria acutifolia	2	1					6/6(50%)		6/6(50%), 6/21	
Astragalus convallarius	2	1						6/21		
Castilleja flava	2	1					6/21			

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Figure 15. Agropyron spicatum/Poa fendleriana habitat type.

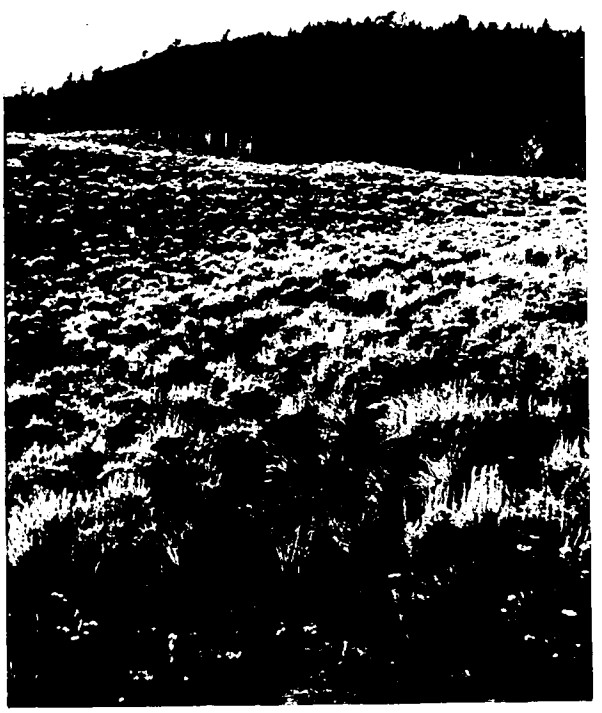

Figure 16. Artemisia tridentata vaseyana/Festuca thurberi habitat type.

ARTEMISIA TRIDENTATA VASEYANA/FESTUCA THURBERI HABITAT TYPE.

This habitat type occurs at high elevations ranging from 8500 to 9500 feet. It is a climatic climax characterized by the distinct dominance of tall growing Artemisia tridentata, vaseyana averaging 27 inches tall (Figure 16). The understory is dominated by large tufts of Festuca therberi and other moisture loving grasses as Poa nevadensis, Stipa columbiana and Carex species. Other important species include Latheyrus leucanthus, Lupinus species, Castilleja flava and Delphinum occidentale. Disturbed sites may be dominated by Chrysothamnus nauseosus.

The characteristics of deep dark Mollic upland soils and its location adjacent to forest habitat types provides good evidence of this habitat type even when the vegetation is disturbed.

Elevations range from 8500 feet to 9500 feet. This habitat type occupies deep dark soils classified as Pachic? Cryoborolls. It occurs at most aspects at high elevations but usually North and East aspects at lower elevations. Deep snow accumulation occurs in winter.

Table 40. Layer and dominance rating (the latter in parentheses) for species in the Artemisia tridentata vaseyana/Festuca thurberi (Stands 202-98) habitat types.

STANDS	202	126	116	93	94	98
FORBS						
Phlox multiflora	2(1)				1(4)	
Penstemon caespitosus			2(3)		1(3)	
Penstemon watsoni	1(3)		2(2)			
Penstemon strictus	2(2)					
Eriogonum umbellatum	2(3)			2(3)		2(3)
Antennaria anaphaloides	2(1)		2(3)			
Mertensia lanceolata		2(3)				
Lupinus ammophilus				2(2)		
Lupinus greenii	2(1)			2(3)		
	2(1)					
Senecio multilobatus			2(3)			
Linum lewisii					2(3)	2(3)
Erigeron eatonii				2(2)		
Astragalus miser			2(3)	2(4)		
Campanula rotundifolia	2(3)					2(1)
Castilleja flava				1(2)	2(3)	
Potentilla concinna				2(3)		
Potentilla fruticosa	2(2)					3(2)
Gilia calcarea				2(1)		
Delphinum occidentale				2(2)		2(2)
Aster	2(1)				2(3)	
Cirsium spp.				3(3)		2(2)
Berberis repens			2(2)			
Sedum stenopetalum	2(3)					2(2)
Lathyrus leucanthus				2(3)		2(3)
Clematis pseudoalpina						
Tryfolium	2(3)					
Vicia americana				2(3)		2(2)
Achillea lanulosa				2(3)		2(3)

Table 40. Continued

STANDS	202	126	116	93	94	98
Taraxacum officinale				2(3)		
Calochortus gunnisoni						2(3)
Aquilegia caerulea	2(1)					
Wyethia sp.				2(2)		
Geranium sp.	2(2)			2(3)		
Rudbeckia sp.				2(2)		
Castilleja sp.						2(3)
Valeriana sp.	2(1)			2(2)		
Collinsia			2(1)			2(1)
Ranunculus sp.	2(3)					
Erigeron sp.						2(3)
Other species				1		1
Dominance of others				2(2)		2(1)
GRASSES & GRASSLIKES						
Agropyron spicatum			2(3)			
Stipa pinetorum		2(3)	2(3)			
Stipa comata	2(2)					
Sitanion hystrix				2(2)		2(2)
Koeleria cristata		2(2)		2(2)	2(4)	2(1)
Poa fendleriana		2(2)	2(3)			
Elymus cinereus		3(2)				
Carex spp.	2(4)	2(3)	2(4)	2(3)	2(3)	2(3)
Poa nevadensis	2(2)	2(2)	2(3)	2(3)		
Bromus spp.				2(3)		
Festuca idahoensis	2(1)		2(2)			
Stipa columbiana	2(3)	2(3)	2(3)	2(4)		2(2)
Bromus anomalus		2(3)		2(4)		
Poa spp.				2(2)		
Agropyron spp.		2(2)		2(3)		2(2)
Festuca thurberi	2(5)			2(4)		3(4)

Table 40. Continued

STANDS	202	126	116	93	94	98
SHRUBS						
Chrysothamnus viscidiflorus	2(3)		2(2)	2(3)	2(3)	
Chrysothamnus nauseosus var. glabratus	2(2)	3(4)		3(2)	3(3)	3(2)
Symphoricarpos oreophilus		3(3)	2(3)	3(4)	2(2)	2(2)
Amelanchier alnifolia						2(1)
Ribes cereum				3(3)	2(3)	
Rosa acicularia						2(1)
Cercocarpus montanus				2(3)		
Artemisia tridentata subsp. vaseyana	3(5)	3(4)	3(5)	3(5)	3(5)	3(4)

Table 41. Phenological data for important species in the Artemisia tridentata vaseyana/Festuca thurberi habitat type (Staud 202).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia tridentata subsp. vaseyana	3	5			5/16,6/6[1]	6/21				
Festuca thurberi	2	5	5/16	6/6		6/21				
Carex sp.	2	4		5/16	6/6					
Chrysothamnus viscidiflorus	2	3	5/16		6/6,6/21					
Stipa columbiana	2	3	5/16	6/6		6/21				
Mertensia lanceolata	2	3					5/16	6/6		
Potentilla concinna	2	3				5/16		6/6,6/21		
Achillea lanulosa	2	3		5/16	6/6	6/21				
Ranunculus sp.	2	3				5/16(50%)[2]	5/16(50%)	6/21		
Clematis pseudoalpina	2	3						5/16,6/6, 6/21		
Eriogonum umbellatum	1	3	5/16,6/6 (90%)			6/6(10%)	6/21			
Geranium sp.	2	2					6/21			
Chrysothamnus nauseosus var. glabratus	2	2	5/16		6/6	6/21				
Delphinum occidentale	2	2			5/16,6/6 (65%)		6/6(35%), 6/21			
Antennaria anaphaloidea	2	2					5/16,6/6, 6/21			
Collinsia sp.	2	2					6/6			
Vicia americana	2	2		5/16			6/6,6/21			
Antennaria rosea	1	2				6/6	6/21			
Stipa comata	2	1				6/21				
Berberis repens	2	1			6/6					
Valeriana sp.	2	1				6/21				
Linum lewisii	2	1				6/21				
Senecio multilobatus	2	1					6/6,6/21			
Festuca idahoensis	2	1				6/21				
Penstemon watsoni	2	1								
Lupinus ammophilus	2	1					6/21			
Aquilegia caerulea	2	1					6/21			

[1]Refers to the date of observation.

[2]The number in parentheses refers to the percent of the particular species that is at this phenological stage.

ARTEMISIA CANA/FESTUCA THURBERI HABITAT TYPE.

This habitat type is characterized by the overstory dominance of Artemisia cana averaging 28 inches tall and an understory dominance of Festuca thurberi. Other commonly associated shrubs include Potentilla fruticosa which increases in abundance with disturbance becoming dominant in early seral stages of succession. Other important species include Bromus anomalus, Poa nevadensis, and Delphinum occidentale (Figure 17).

Elevations range from 8000 to 9700 feet. Slopes are usually less than 10%. This habitat type is a topographic climax that occupies alluvial floodplains near willow (Salix sp.) stream bottoms and adjacent to aspen and Douglas fir forest communities. Soils are usually cold, deep Mollisols (cumulic or pacil) classified as members of the fine montmorillonite family of Boralfic Cryoborolls. Mord and Cimarron series are characteristic soils in this type.

This habitat type is colder and more mesic than the Artemisia tridentata habitat types. It has an environment similar to the Amelanchier alnifolia/Carex habitat type but is not restricted to snow drift microsites, although snow depths usually become deep in winter. Aspen dominates at slightly warmer and moister environments. Colder and moister environments support spruce forest communities.

Table 42. Layer and dominance rating (the latter in parentheses) for species in the Artemisia cana/Festuca thurberi habitat type.

STANDS	125	124	203
FORBS			
Eriogonum umbellatum	2(3)	2(2)	2(3)
Mertensia lanceolata		2(2)	2(2)
Lupinus ammophilus		2(1)	
Lupinus greenii	2(3)		
Senecio sp.			3(3)
Linum lewisii		2(2)	
Campanula rotundifolia		2(2)	
Castilleja flava	2(3)		
Potentilla concinna			2(1)
Potentilla fructicosa	3(3)	2(3)	3(2)
Delphinum occidentale	3(3)	3(2)	2(2)
Artemisia ludoviciana		2(2)	
Cirsium spp.		2(1)	
Lathyrus leucanthus	2(3)	2(3)	
Clematis pseudoalpina			2(2)
Tryfolium			2(1)
Vicia americana	2(3)		2(2)
Achillea lanulosa	2(3)	2(3)	2(3)
Antennaria rosea		1(1)	1(1)
Taraxacum		2(1)	
Aquilegia caerulea			2(1)
Wyethia sp.			2(2)
Geranium	2(3)	2(1)	
Rudbeckia		2(2)	
Fraseria speciosa		2(1)	2(2)
Collinsia			3(3)
Ranunculus sp.			2(3)
Taraxacum officinale			2(3)
Erigeron	2(3)	2(3)	
Other species	2	2	
Dominance of others	2(2)	2(2)	

Table 42. Continued

STANDS	125	124	203
GRASSES & GRASSLIKES			
Stipa pinetorum		2(3)	
Poa nevadensis	3(3)	2(3)	
Bromus spp.			2(1)
Poa pratensis		2(3)	
Poa spp.			2(4)
Stipa columbiana	3(3)	2(3)	
Carex spp.	2(2)		2(1)
Bromus anomalus	3(4)	2(3)	
Agropyron spp.	3(3)	2(3)	
Festuca thurberi	3(4)	2(5)	3(4)
Stipa spp.	3(2)	2(3)	
SHRUBS			
Chrysothamnus nauseosus var. glabratus	3(2)		3(3)
Symphoricarpos oreophilus	3(2)		
Amelanchier alnifolia		3(1)	
Artemisia cana	3(5)	3(5)	3(5)

Table 43. Phenological data for important species in the Artemisia cana/Festuca thurberi habitat type (Stand 203).

Species	Layer	Dominance	Begin Growth	1/2 Leaf	Full Leaf	Flower Visible	Full Flower	Anthesis	Seed Set	Dormant
Artemisia cana	3	5	5/16[1]	6/6	6/21					
Festuca thurberi	3	4	5/16	6/6		6/21				
Poa sp.	2	4	5/16,6/6			6/21				
Chrysothamnus nauseosus var. glabratus	3	3	5/16		6/6					
Collinsia sp.	3	3					6/6,6/21			
Senecio sp.	3	3					6/21			
Ranunculas sp.	2	3					5/16	6/6		
Achillea lanulosa	2	3			5/16,6/6		6/21			
Taraxacum officinal	2	3			5/16		6/6,6/21			
Eriogonum umbellatum	2	3			5/16,6/6		6/21			
Potentilla fruticosa	3	2	5/16		6/6	6/21(67%)	6/21(33%)[2]			
Poa nevadensis	2	2	5/16			6/21				
Delphinum occidentale	2	2			5/16,6/6 (90%)		6/6(10%), 6/21			
Valeriana sp.	2	2		5/16	6/6,6/21(90%)	6/21(10%)				
Vicia americana	2	2					6/21			
Mertensia lanceolata	2	2					5/16,6/6			
Clematis pseudoapina	2	2			5/16		6/6,6/21 (35%)	6/21(65%)		
Wyethia sp.	2	2			6/21					
Crepis acuminata	2	2			6/6					
Bromus	2	1			6/21					
Tryfolium sp.	2	1					6/21			
Potentilla concinna	2	1		6/6			6/21			
Heuchera parvifolia	2	1				6/21				
Aquilegia caerulea	2	1					6/21			
Carex sp.	1	1		6/6						
Antennaria rosea	1	1			5/16,6/6					

[1] Refers to the date of observation

[2] The number in parentheses refers to the percent of the particular species that is at this phenological stage.

Figure 17. Artemisia cana/Festuca thurberi habitat type.

LITERATURE CITED

Beetle, A. A. 1960. A study of Sagebrush. Wyo. Agr. Exp. Sta. Bull. 368. 83pp.

Daubenmire, R. F. 1970. Steppe vegetation in Washington. Wash. Agric. Exp. Stn. Tech. Bull. 62, 131p.

Harrington, H. D. 1964. Manual of the plants of Colorado. Swallow Press Inc., Chicago, Ill. 666p.

Izett, Glen A. 1968. Geology of the Hot Sulphur Springs Quadrangle, Grand County, Colorado. Geological Survey Professional Paper 586. U.S. Gov. Printing Office, Washington, D.C. 79p.

Izett, G. A. and C. S. Venable Barclay. 1973. Geologic map of the Kremmling Quadrangle, Grand County, Colorado. U.S. Dept. of Interior, Geological Survey, Geologic Quadrangle Map, Washington, D.C.

Stevens, R. and E. D. McArthur. 1974. A simple field technique for identification of some sagebrush taxa. J. Range Manage. 27:325-326.

U.S. Dept. of Commerce. 1977. National Oceanic and Atmospheric Administration, Climatological Data, Environmental Data Service, Colorado.

APPENDIX A

Mapping unit identification legend for the habitat types mapped for the mule deer critical winter range in Middle Park, Colorado.

Map Symbol	Acres	Mapping Unit Description
1	197	Amelanchier alnifolia/Agropyron spicatum habitat type. As much as 15% of the area may include the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
1-8	46	60% of the area is the Amelanchier alnifolia/Agropyron spicatum habitat type and 40% of the area is the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type.
2	23	Amelanchier alnifolia/Carex habitat type. As much as 15% of the area may include the Artemisia tridentata vaseyana/Festuca idahoensis habitat type.
2-9	92	60% of the area is the Amelanchier alnifolia/Carex habitat type and 40% of the area is the Artemisia tridentata vaseyana/Festuca idahoensis habitat type.
3	148	Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type.
3-5	249	70% of the area is the Sarcobatus vermiculatus-Artemisia tridentata tridentata/Agropyron smithii habitat type and 30% of the area is the Oryzopsis hymenoides/Eriogonum brevicaule habitat type.
4	141	Juniperus scopulorum/Agropyron spicatum habitat type. As much as 10% of the area may include the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type or the Agropyron spicatum/Artemisia frigida habitat type.
4-6	473	65% of the area is the Juniperus scopulorum/Agropyron spicatum habitat type and 35% of the area is the Agropyron spicatum/Artemisia frigida habitat type.

Map Symbol	Acres	Mapping Unit Description
4-11	75	70% of the area is the Juniperus scopulorum/Agropyron spicatum habitat type and 30% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
5	12	Oryzopsis hymenoides/Eriogonum brevicaule habitat type.
6	567	Agropyron spicatum/Artemisia frigida habitat type. As much as 10% of the area may include the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
6-9	64	70% of the area is the Agropyron spicatum/Artemisia frigida habitat type and 30% of the area is the Artemisia tridentata vaseyana/Festuca idahoensis habitat type.
6-11	443	60% of the area is the Agropyron spicatum/Artemisia frigida habitat type and 40% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
6-11-7	791	40% of the area is the Agropyron spicatum/Artemisia frigida habitat type, 30% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type and 30% of the area is the Artemisia tridentata tridentata/Agropyron smithii habitat type.
7	119	Artemisia tridentata tridentata/Agropyron smithii habitat type.
7-11	87	75% of the area is the Artemisia tridentata tridentata/Agropyron smithii habitat type and 25% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
8	460	Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type. Fragments of most other habitat types that occur in the mule deer critical winter range may be included in the area.
8-1	85	75% of the area is the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type and 25% of the area is the Amelanchier alnifolia/Agropyron spicatum habitat type.

Map Symbol	Acres	Mapping Unit Description
11-8	16	70% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type and 30% of the area is the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type.
11-9	459	70% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type and 30% of the area is the Artemisia tridentata vaseyana/Festuca idahoensis habitat type.
12	52	Riparian vegetation dominated by Salix sp.
12-7	73	60% of the area is riparian vegetation and 40% of the area is the Artemisia tridentata tridentata/Agropyron smithii habitat type.
13	20	Pseudotsuga menziesii habitat type.
Total Acres		
	7694	

Map Symbol	Acres	Mapping Unit Description
8-6	53	60% of the area is the Chrysothamnus parryi-Oryzopsis hymenoides/Eriogonum brevicaule habitat type and 40% of the area is the Agropyron spicatum/Artemisia frigida habitat type.
9	729	Artemisia tridentata vaseyana/Festuca idahoensis habitat type. A few areas have small inclusions of Aspen, the Amelanchier alnifolia/Carex habitat type or the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
9-2	68	65% of the area is the Artemisia tridentata vaseyana/Festuca idahoensis habitat type and 35% of the area is the Amelanchier alnifolia/Carex habitat type.
9-6	32	65% of the area is the Artemisia tridentata vaseyana, Festuca idahoensis habitat type and 35% of the area is the Agropyron spicatum/Artemisia frigida habitat type.
9-7	30	80% of the area is the Artemisia tridentata vaseyana/Festuca idahoensis habitat type and 20% of the area is the Artemisia tridentata tridentata/Agropyron smithii habitat type.
9-11	622	70% of the area is the Artemisia tridentata vaseyana/Festuca idahoensis habitat type and 30% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type.
10	515	Artemisia tridentata wyomingensis/Agropyron smithii habitat type.
11	718	Artemisia tridentata wyomingensis/Agropyron spicatum habitat type. As much as 15% of the area may include the Agropyron spicatum/Artemisia frigida habitat type.
11-6	235	75% of the area is the Artemisia tridentata wyomingensis/Agropyron spicatum habitat type and 25% of the area is the Agropyron spicatum/Artemisia frigida habitat type.